Science for Teachers 536D

Two Credit Hours

Prerequisites: ST 556-Computers and Science Teaching

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Course Designation: Information Systems

Course Description: Students will learn a cross section of concepts that will bring them an understanding of Information Technology. Major aspects of Information Technology will be presented with enough detail so that students will understand the way technology works and the impact it is having on society and their lives. Each student will be required to complete various assignments, a Mid Term and a Final Exam.

Materials, Readings, and Resources: This is a self-paced class, with lectures available via online recorded streaming or downloadable recordings (flash or i-pod). The instructor is available for questions by phone, e-mail or appointment.


Course Content:

• Discuss the evolution of computers, including societal events leading to increased demands and technological developments (historical perspective).
• Identify the basic parts and functions of computer systems (competence in information technology).
• Learn and discuss the major components (hardware) of a computer system.
• Differentiate between the roles and functions of application and systems software, operating systems and how they both interact with the computer user and the hardware.
• Study the development of Applications Software as it relates to teaching and career development. Learn the background, concept and features available in Word Processing, Spreadsheets, Databases, and Presentations.
• Learn how the Internet makes the World-Wide Web available and how they work together.
• Learn how programmers do what they do and how the computer understands programs.
• Discuss major issues in Information Technology Ethics and Security.
• Discuss how Information Technology is made to match an organization’s needs and goals.
• How can all of this information be used in the classroom?

Course goals:

Fundamentals of Information Technology is an introductory course aimed at presenting an overview and a foundation of concepts relating to information technology and the fundamentals that allow us to function intelligently in this information age.
The goal of this course is for the student to feel more computer literate when the course is finished. Literacy means understanding the history and background of these standard products and the basic computer terminology necessary to gain competence.

**Schedule:** Self-paced. Students have one semester to complete this course.

**Attendance:** Via recorded Web stream, or downloadable recorded lectures (flash or i-pod).

**Grading:** Grades will be based on assignments, Mid Term and Final Exam Grades.

**Assessment:** Student learning is assessed by student performance on homework and exams.

**Help:** Students are strongly encouraged to work together, but each student is expected to do their own work. This means it is not acceptable for students that may have collaborated to submit one paper, or papers that are the same in content, effort, or format. If similar assignments are submitted this will result in a failing grade for all the students involved.

### COMPETENCIES FOR ENTRY-LEVEL SCIENCE TEACHERS:

#### A. Instruction and Assessment: Preparation to teach science shall involve:

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<tr>
<th>(1) Inquiry, Including the Scientific Method</th>
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<td>(a) Select and use a variety of instructional strategies and materials for teaching science meeting the needs of all students.</td>
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<td>(b) Implement active inquiry based learning activities conducive to the development of scientific processes, critical thinking skills, and problem solving skills.</td>
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<td>(c) Implement design technology/scientific method: identify a problem; propose a solution; implement proposed solutions; evaluate product or design; communicate a problem, design, and solution.</td>
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<td>(d) Implement technology, including computers, interactive video, telecommunication, scientific instrumentation, and others.</td>
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<th>(2) Content Integration</th>
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<td>(a) Develop student understanding of the interconnectedness of the sciences and relate the major concepts of chemistry, earth and space science, physics, and biology to the teaching of science.</td>
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<td>(b) Develop meaningful application of all content areas, including math, technology, language arts, social studies, and arts, in the delivery of science instruction.</td>
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<th>(3) Designing and Managing Learning Environment</th>
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<td>(a) Fulfill the professional and legal obligations of teaching.</td>
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<td>(b) Incorporate the proper use of science tools, materials, media, and technological resources.</td>
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<td>(c) Establish and maintain safety in all areas related to science instruction.</td>
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<td>(d) Use and care for living organisms in an ethical and appropriate manner.</td>
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<th>(4) Effective and Ongoing Assessment to Improve Student Learning</th>
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(a) Use assessment techniques such as performance testing, interviews, portfolios, and observations, for assessing student outcomes which are aligned with instruction and consistent with contemporary assessment.

(b) Use assessment tasks which may be appropriately modified to accommodate the needs of students with physical disabilities, learning disabilities, limited English proficiency, and cultural diversity.

### B. History and Nature of Science: Preparation to teach science shall include:

1. **Diversity and Human Endeavor**
   - (a) Describe science careers and reasons why people choose science as a career, including the impact of culture, gender, and other, factors.
   
   - (b) Describe the science contributions of people from a variety of social and ethnic backgrounds who have diverse interests, talents, qualities, and motivations.
   
   - (c) Develop student understanding of the relationships among science, technology, and cultural values.
   
   - (d) Recognize and respond to student diversity and encourage all students to participate fully in science learning.

2. **Empirical Observation**
   - (a) Explain that science distinguishes itself from other bodies of knowledge through the use of empirical standards, logical argument, and skepticism.
   
   - (b) Explain that scientific ideas depend on experimental and observational confirmation.

3. **Historical Perspectives**
   - (a) Understand that the body of scientific knowledge is continually being expanded and refined.
   
   - (b) Explain how theories and ideas throughout the history of science are refined or discarded as new evidence becomes available.
   
   - (c) Explain how Western, non-European, and New Mexican cultures have developed scientific ideas and contributed to scientific knowledge.

### C. Content Categories: The following areas are designed to allow potential science teachers to construct their pre-service education with an emphasis in one content area, while insuring they receive science education in any area which they might be required to teach. Preparation to teach science shall enable the teacher to understand and be able to teach within at least one of these emphases:

1. **Life Science Emphasis:** All science teachers, grades K-12 will be able to identify and understand the relationship among major concepts and principles of biology, including anatomy, physiology, ecology, behavior of organisms, evolution, genetics, cell biology, microbiology, classification, and human biology.
   - (a) Teachers know and understand the characteristics that are the basis for classifying organisms.
   
   - (i) Teachers for grades K-4 will demonstrate an awareness of living things including basic cellular functions and processes, structures, the roles of organisms in systems comprised of living and non-living components and describe life cycles of plants and animals.
(ii) Teachers for grades 5-8 will use information about functions and cell structures to explain replication, reproduction, heredity, and disease, and categorize organisms based on methods of reproduction and offspring development.

(iii) Teachers for grades 9-12 will apply information about cell structures and functions to the world in which they live including understanding of DNA, RNA, natural selection processes, and diversity in plants and animals and use biological classifications to understand how organisms are related.

(b) Teachers will know and understand the synergy among organisms and the environments of organisms.

(i) Teachers for grades K-4 will explain how an organism's behavior is related to its physical environment; describe the roles of plants and animals in the flow of energy; describe how environmental pressures may accelerate changes in organisms; describe populations, communities, and systems; describe the impact humans have on the environment; understand natural resources (renewable versus non-renewable) and how each relates to humans' basic needs, and describe elements essential to good health.

(ii) Teachers for grades 5-8 will understand organisms' physical and behavioral adaptations and how changes occur over time; describe how organisms meet their needs, grow, and reproduce while sustaining stable local surroundings within an ever-changing larger environment; predict organisms' behaviors that may result from external stimuli; use information about variation and diversity to explain population changes over time; categorize organisms based on their roles within the ecosystem in which they live; examine the impact humans have on the living and non-living world including issues related to overpopulation; illustrate the relationships among renewable and non-renewable resources and population, and model responsible health practices including issues relating to nutrition and exercise.

(iii) Teachers for grades 9-12 will explain cellular responses to environmental threats to the organism ranging from the production of antibodies to changes in coloration; understand the pathways of energy within a living organism; predict an organism's behavioral responses to internal and external changes and to external stimuli as a function of inherited and acquired characteristics; create models that mimic a population's response to internal and external environment pressures; predict the impact humans might have on a species or system including resource depletion and over population, and interpret the relationships between personal choices and health.

(2) Physical Science Emphasis: All science teachers, grades K-12, will be able to identify and understand the relationships among chemistry concepts including organic, inorganic, analytical, physical, and biochemical and identify and understand the relationships among physical concepts including mechanics, electricity, magnetism, thermodynamics, waves, optics, atomic, and nuclear physics.

(a) Teachers will be able to know and understand the properties of matter.

(i) Teachers for grades K-4 will describe the observable properties of common items and substances and explain that elements are the basic units of all matter.

(ii) Teachers for grades 5-8 will identify the properties of elements and compounds such as density, boiling point, and solubility and that these characteristics are independent of amount of the sample and articulate that chemical reactions occur in a predictable fashion and that the formation of compounds adheres to imperatives as conservation of matter.
(iii) Teachers for grades 9-12 will compare and contrast elements and compounds based upon the knowledge of the atomic/subatomic structures of matter and predict how atoms interact based upon sharing or transference of outer electrons.

(b) Teachers will know and understand the properties of fields, forces, and motion.

(i) Teachers for grades K-4 will describe how an object may be described with regard to its relative position to other objects; explain that an object's motion may be described by indicating change over time and describe how the earth's gravity pulls objects toward it.

(ii) Teachers for grades 5-8 will illustrate how Newton's Laws describe objects in motion; describe quantitatively how an object's position, speed and motion explain motion and compare and contrast forces affecting the physical world.

(iii) Teachers for grades 9-12 will apply knowledge of the constancy of energy in the universe and the forms that energy take in daily life; predict the motion of an object based on the net applied force applied to the object and explain and graphically describe that a specific mass exerts a force on others masses (velocity and acceleration).

(c) Teachers will know and understand the concepts of energy and energy transformation.

(i) Teachers in grades K-4 will describe the basic characteristics of light, heat, sound, and electromagnetism, and explain that energy exists in many forms and can be transformed and describe the process of chemical reactions and how time is a factor in chemical reactions.

(ii) Teachers in grades 5-8 will apply knowledge of energy and energy transformation to science problems; explain how chemical reactions can take place over periods of time and explain how concentration, pressure, temperature, and catalysts may affect chemical reactions.

(iii) Teachers in grades 9-12 will demonstrate their understanding of energy by identifying examples of transformations within and outside the school environment and devise scientific investigations demonstrating the impact of temperature and other variables on chemical reactions.

(3) Earth and Space Science Emphasis: All science teachers, grades K-12, will know and understand properties of earth and space science.

(a) Teachers in grades K-4 will describe the physical and chemical properties of earth's materials and the states of matter; describe the uses of earth's materials as resources and the sun as the major source of energy; describe changes in the earth's surface; describe changes in weather; recognize that fossils provide a record of animals and plants that lived long ago; represent the school and local community using symbols and maps; describe basic components of and movements within the solar system; identify the types of instruments and vehicles used for space exploration and describe human's movement toward space from early observations to recent explorations.
(b) Teachers in grades 5-8 will explain how earth's materials can be transformed from one state to another; experiment with earth's materials using them as resources; model natural resources that shape the earth's surface; observe, measure, and record weather changes; explain how fossils are formed and how fossils provide evidence of complexity and diversity over time; use rectilinear coordinate systems such as latitude and longitude to locate points on the earth's surface; describe the interactions among the earth's lithosphere, hydrosphere, atmosphere, and biosphere; explain simple data derived from recent remote and direct observations in the solar system and space beyond; model the predictable patterns of the sun and planets in the solar system and cite benefits from continued exploration of space.

(c) Teachers in grades 9-12 will evaluate information about earth's materials, energy, and geochemical cycles; model the interaction between the earth's internal and external energy sources; use tectonic theory to predict changes in the earth's surface; model weather patterns and other natural cycles related to the movement of matter driven by the earth's internal and external sources of energy; use fossil and other evidence to investigate how the earth changes; extend mapping techniques to learning in science and other content areas; explain the evolution of earth in terms of the interactions among the geosphere, hydrosphere, atmosphere, and biosphere; model interactions between components of the earth based on the understanding of the earth as a system containing a fixed amount of each stable chemical or element; trace the development of space exploration and discuss how recent missions impact understanding of the earth; evaluate the hierarchy of structures in the universe from atoms to galaxies and identify the pros and cons of various scientific theories for the origin of the universe based on scientific evidence.

(4) Environmental Science Emphasis: All science teachers, grades K-12, will be able to identify and apply major concepts of environmental science such as ecosystems, energy flow, population ecology, natural resources, meteorology, geology, oceanography, and conservation.

D. Environmental, Personal and Social Implications: Preparation to teach science shall enable teachers to understand and be able to teach:

(1) Personal, community, New Mexico and global environmental issues;
(2) The approaches to evaluate the ethical implications of new developments in science;
(3) Personal and community health issues;
(4) Decision-making and value-analysis skills for investigating science-related societal problems;
(5) Ethical use and care of living organisms.

E. Professionalism: Teacher education programs shall develop reflective practitioners who:

(1) Foster in their students scientific interest and curiosity.
(2) Participate in professional scientific organizations.
(3) Serve as representatives of the scientific community.
(4) Engage students in coherent, focused, student centered science curriculum, consistent with state and national standards.
(5) Identify and use a variety of community resources including local expertise, industry, local environmental settings, and families.
(6) Take advantage of collaborative planning among colleagues, scientists, and science teacher educators, so that science, science methods, and other program components are mutually reinforcing.

(7) Explore and evaluate the process of curriculum and instructional implementation.

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<th>COMPETENCIES FOR ENTRY-LEVEL MATHEMATICS TEACHERS</th>
<th>Addresses competency</th>
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**A. Teachers will understand and use Mathematics in Problem-Solving.**

1. Teachers for grades K-8 will be able to:
   - Use problem-solving approaches to investigate and understand mathematical content.
   - Formulate and solve problems from both mathematical and everyday situations.
   - Identify, select and use appropriate problem-solving strategies; as well as develop and apply their own strategies.
   - Verify and interpret solutions to problems.
   - Use mathematical language and symbolism to model problem situations.

2. Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

3. Teachers for grades 7-12 will be able to:
   - Use a problem solving approach to investigate and understand mathematical concepts.
   - Formulate and solve problems from both mathematical and everyday experiences.
   - Develop their own processes and techniques for solving problems.

**B. Teachers will understand and use Mathematics in Communication.**

1. Teachers for grades K-8 will be able to:
   - Identify and define mathematical concepts in a variety of situations.
   - Communicate mathematical ideas both verbally and in writing.
   - Use drawings, discussion, reading, and listening to learn and communicate mathematical ideas.
   - Use a variety of electronic media and manipulatives to explore and communicate mathematical concepts and problem solutions.

2. Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

3. Teachers for grades 7-12 will be able to:
   - Develop skills in both written and oral communication of mathematical concepts.
   - Learn to communicate effectively at various levels of formality and with people who have differing levels of mathematical understanding.

**C. Teachers will understand and Use Mathematics in Reasoning.**

1. Teachers for grades K-8 will be able to:
   - Describe logical conclusions.
   - Use information sources, models and known facts to explain mathematical thinking.
   - Make and evaluate mathematical conjectures and validate their own mathematical
(d) Recognize and construct logical arguments for mathematical statements, concepts, and principles.

(e) Apply a variety of reasoning processes to include deductive and inductive reasoning.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:
   (a) Recognize patterns, make and refine conjectures and definitions, and construct both formal and heuristic proofs.
   (b) Judge the validity of mathematical arguments.
   (c) Formulate counterexamples.

**D. Teachers will understand and use Mathematical Connections.**

(1) Teachers for grades K-8 will be able to:
   (a) Show an understanding of the interrelationships within mathematics.
   (b) Connect mathematics to other disciplines and everyday situations.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:
   (a) Develop an understanding of the interrelationships within mathematics and an appreciation of its unity.
   (b) Understand and appreciate the power of mathematical language and symbolism in the development of mathematical concepts.
   (c) Explore the connections between mathematics and other disciplines.
   (d) Apply mathematics learned in one context to other contexts.

**E. Teachers will understand and use numbers, and their relationships, systems and theory.**

(1) Teachers for grades K-8 will be able to:
   (a) Construct number meanings through everyday experiences and the use of physical materials.
   (b) Understand prenumeration concepts.
   (c) Describe and compare ancient and modern numeration systems by relating counting, grouping, and place value concepts.
   (d) Develop number sense.
   (e) Identify different sets of numbers in the real number system.
   (f) Understand representations of numbers, including mixed numbers, fractions, decimals, and scientific notation.
   (g) Demonstrate ability to use models to explore and explain relationships among fractions, decimals, percents, ratios, and proportions.
   (h) Use the relations of equality and inequality.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to: Explore and discuss the properties, relations, and extensions of the real and complex numbers.

**F. Teachers will understand and use computation and estimation.**

(1) Teachers for grades K-8 will be able to:
(a) Model, explain, and develop proficiency with the basic number facts and algorithms, including addition, subtraction, multiplication and division.

(b) Recognize alternative algorithms for the four basic operations.

(c) Select and use computation techniques appropriate to specific problems and determine the reasonableness of solutions.

(d) Use estimation strategies.

(e) Recognize when estimates are appropriate.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:

(a) Understand and apply numerical computational and estimation techniques and extend them to symbolic expressions.

(b) Use estimation to assess the reasonableness of solutions.

G. Teachers will have a foundation in geometric concepts.

(1) Teachers for grades K-8 will be able to:

(a) Describe, model, draw and classify geometric figures.

(b) Investigate, predict, and describe the results of combining, subdividing and changing shapes.

(c) Develop spatial sense and relationships.

(d) Relate geometric and measurement ideas.

(e) Use geometric concepts and relationships to describe and model mathematical ideas and relationships to the world.

(f) Solve simple problems in two- and three-dimensional geometry involving parallelism, perpendicularity, congruence, similarity, translation, reflection, rotation, symmetry, and incidence.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:

(a) Understand the role of axiomatic systems in geometry.

(b) Develop both synthetic and algebraic geometric concepts using coordinates and vectors.

(c) Use geometry as a source of mathematical models for a variety of applications.

(d) Employ geometric reasoning as a problem solving strategy.

(e) Model features of the real world using different geometries.

H. Teachers will understand and use measurement.

(1) Teachers for grades K-8 will be able to:

(a) Determine what needs to be measured, select an appropriate unit of measurement, and then select an appropriate tool with which to measure.

(b) Use standard and nonstandard units for measurement to an appropriate degree of accuracy.

(c) Use estimation, informal procedures, and formulas to solve problems involving linear measures, area, volume, mass, and temperature by using both traditional and metric systems.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:
(a) Identify and use the appropriate units, tools of measurement, and degree of accuracy required in particular problems, making calculations of relative error as necessary.

(b) Apply measurement as a tool in other disciplines

**I. Teachers will understand and use statistics and probability.**

(1) Teachers for grades K-8 will be able to:

(a) Collect data from real world experiences or surveys, organize and display data using various charts/graphs manually and by using appropriate technology, analyze and interpret the data, and write convincing arguments based on the data.

(b) Solve elementary statistical problems relating to measures of central tendency, measures of dispersion, regression equations, and non-linear regression.

(c) Critically examine and analyze data for reliability and validity.

(d) Demonstrate an understanding of randomness by conducting sampling experiments.

(e) Find experimental and theoretical discrete probabilities using sample spaces, tree diagrams, and other representations.

(f) Plan and conduct simulations to determine experimental probabilities.

(g) Compute the mathematical expectation of simple games and lotteries.

(h) Solve simple problems involving probability, inference, and the testing of hypotheses.

(i) Use simple combinations and permutations to solve counting problems.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:

(a) Understand measures of central tendency, variability, and correlation.

(b) Collect, display, analyze, and interpret sample data in a variety of situations.

(c) Investigate the role of estimation and probability in statistical analysis.

(d) Use experimental and theoretical probabilities to formulate and solve problems.

(e) Develop strategies for reasoning and making decisions based on uncertainty.

(f) Explore the probabilistic nature of statistical analyses including hypothesis testing, correlation, analysis of variance, and nonparametric methods.

**J. Teachers will understand and use patterns and functions.**

(1) Teachers for grades K-8 will be able to:

(a) Recognize, describe, extend, and create a wide variety of patterns.

(b) Represent relationships with manipulatives, tables, graphs, verbal and written statements, and formulas.

(c) Describe what a function means both intuitively and using formal mathematical language.

(d) Demonstrate a basic understanding of classes of functions and their properties; e.g. linear, exponential, polynomial, and periodic.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:

(a) Use multiple representations of functions, including symbolic expressions, verbal descriptions, tables, and graphs, and relate one representation to another.
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(b) Use the language of functions to describe and model change.
(c) Use the concept of function in the study of mathematics and other disciplines.

**K. Teachers will understand and apply algebraic concepts.**

(1) Teachers for grades K-8 will be able to:
   (a) Explore and use variables and open sentences to express mathematical relationships.
   (b) Solve real-world problems involving linear and quadratic equations and inequalities by using traditional techniques and graphing methods that use technology.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:
   (a) Understand and apply the major concepts of linear and abstract algebra.
   (b) Use theoretical results to understand tangible situations.

**L. Teachers will understand and apply concepts of calculus.**

(1) Not required of teachers for grades K-8.

(2) Teachers for grades 5-9 will be able to:
   (a) Recognize particular types of change such as linear, quadratic, and exponential.
   (b) Use graphs, diagrams, charts, physical models, and graphing technology to explore the notions of limit, differentiation, and integration, and interpret the relationships among them.
   (c) Construct infinite sequences and series, relating them to non-terminating decimals and the approximation of functions.
   (d) Solve real-world problems involving average and instantaneous rates of change, area, volume, and curve length, and relate those to differentiation and integration.

(3) Teachers for grades 7-12 will be able to:
   (a) Investigate the phenomenon of change as a limiting process.
   (b) Explore intuitively and in depth the concepts of limit, continuity, differentiation, and integration.
   (c) Demonstrate an understanding of the underlying theory of analysis.
   (d) Use properties and techniques of calculus to model phenomena in diverse settings.

**M. Teachers will understand and apply discrete processes.**

(1) Not required of teachers for grades K-8.

(2) Not required of teachers for grades 5-9.

(3) Teachers for grades 7-12 will be able to: Understand concepts and applications of discrete mathematics, such as graph theory, recurrence relations, linear programming, difference equations, and combinatorics.

**N. Teachers will understand the use of technology.**

(1) Teachers for grades K-8 will be able to:
   (a) Use calculators and computers to represent mathematical ideas and construct different representations of mathematical concepts.
   (b) Use calculators and computers to develop and use alternate strategies for solving problems.
   (c) Use networking and information technologies to solve problems and broaden the

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scope of inquiry.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:
   (a) Engender a broad array of mathematical modes of thinking through the use of powerful computing tools (including function graphers, curve fitters, symbolic manipulators, dynamic geometric software, and programming languages).
   (b) Use calculators, spreadsheets, and statistical packages to solve problems. X
   (c) Use technology to explore probabilities through simulations.
   (d) Use graphing calculators and computer algebra systems in the study and application of the calculus.

O. Teachers will develop perspectives on mathematics as a human endeavor.

(1) Teachers for grades K-8 will be able to:
   (a) Understand the dynamic nature of mathematics and its increasingly significant role in social, cultural, and economic development.
   (b) Develop an appreciation for the contributions made by various cultures to the growth and development of mathematical ideas.
   (c) Investigate the contributions made by individuals, both female and male, and from a variety of cultures, in the development of ancient, modern, and current mathematical topics.
   (d) Gain an understanding of the historical development of major school mathematics concepts.

(2) Teachers for grades 5-9 will be able to meet the Standards set for K-8 teachers.

(3) Teachers for grades 7-12 will be able to:
   (a) Explore the dynamic nature of mathematics and its increasingly significant role in social, cultural, and economic development.
   (b) Gain an understanding of the historical development of major school mathematics concepts.
   (c) Understand the historical development of non-Euclidean geometries and the questions relating to the parallel postulate involved in this development.
   (d) Develop an appreciation of the contributions made by the various cultures to the growth and development of mathematical ideas.
   (e) Investigate the contributions made by individuals, both female and male, and from a variety of cultures, in the development of ancient, modern, and current mathematical topics.