

Master of Science for Teachers (MST)

Interdepartmental Program within the Department of Psychology and Education (Mark Samuels, Department Chair, George Becker, Coordinator)

***Advisory Committee:** Jeff Altig (Chemistry), William Chávez (Mineral Engineering), Steve Simpson (Communication, Liberal Arts, and Social Sciences), Dave Westpfahl (Physics), Bruce Harrison (Earth and Environmental Science), Dongwan Shin (Computer Science), Warren Ostergren (Vice President of Academic Affairs)), Rebecca Reiss (Biology), Anwar Hossain (Mathematics)→; Ex-Officio: Associate Vice President of Academic Affairs, Graduate Dean, Dean of Arts and Sciences, Dean of Engineering, Director of the Academic Center for Technology, Vice-President of Student and University Relations, Director of Professional Development, Registrar.*

Other Departmental Faculty Teaching MST Courses: Jeff Altig (Chemistry), Brian Borchers (Math), William Chavez (Mineral Engineering), Lynn Deming (Humanities), Julie Ford (Humanities), Dee Friesen (Physics), Bruce Harrison (Earth and Environmental Science), Rob Hepler (Computer Science), Anwar Hossain (Math), Janet Kieffer (Humanities), Dan Klinglesmith (Physics), Kenneth Minschwaner (Physics), Rebecca Reiss (Biology), Clinton Richardson (Civil and Environmental Engineering), Eileen Ryan (Physics), Steve Simpson (Humanities), Richard Sonnenfeld (Physics), Elisabeth Stone (Earth and Environmental Science), William Stone (Math), David Thomas (Psychology), David Westpfahl (Physics)

Adjunct Faculty: ~~Ray Collins, Lynn Deming, Dee Friesen, Rob Hepler, Dan Klinglesmith, Lynne Kurilovitch, Eileen Ryan, Elisabeth Stone, Dave Thomas,~~ and Don Wolberg

Degree Offered: Master of Science for Teachers

Program Description

The MST program is designed to provide graduate-level classroom and laboratory instruction for teachers of science, mathematics, engineering, and/or technology. The emphasis of the courses is on content, rather than pedagogy. MST students are encouraged to develop laboratory exercises, demonstrations, and teaching methods from the course content and apply these as projects in their own classrooms during the academic year. Courses for the participants are offered in a variety of disciplines and are taught by New Mexico Tech faculty. Classes build on fundamental principles and offer new concepts and novel teaching methods. Courses are offered throughout the year via distance instruction and as live courses on the New Mexico Tech campus and around the state.

Program Prerequisites

An individual with at least one year of teaching experience may apply for admittance into the MST Program. The Program encourages individuals to hold a valid teaching certificate when appropriate.

Transfer Credit Policy

A maximum of 12 credit hours of course work with grade B or better, earned at another accredited institution, may be approved by the student's advisory committee for transfer to the MST program. To be approved, credits must not have been used to satisfy the requirements for a previous

degree. Transfer credits can include upper-division undergraduate or graduate credit in science, mathematics, engineering, and/or technology. Transferred credits may include up to six credit hours of professional education courses in areas generally appropriate to this program. Requests for evaluation of transfer credit hours must be made in writing to the program coordinator and must include the transfer credit form and official transcripts.

Application for Admission

Application forms may be obtained from the internet at www.nmt.edu/~grad/. Printed forms or more information can be requested by e-mail from graduate@nmt.edu or by mail from:

Master of Science for Teachers
Graduate Office
801 Leroy Place, New Mexico Tech,
Socorro, NM 87801

MST Fellowships

The MST Office maintains a list of available fellowships.

Endorsement Policy

Information regarding certification endorsements may be obtained from the New Mexico Public Education Department, Santa Fe, New Mexico.

Placement Exams

MST students may take placement exams for ST: 523, 524, 525, 526, or 550. Upon successful completion of the exam(s), this requisite for the program will be waived and the student will not be required to take the course(s). The exams consist of questions covering basic concepts of science and mathematics.

Use of Tech Facilities

If an MST student is utilizing New Mexico Tech facilities or faculty (i.e., computer center, advisor, or graduate committee), the student must be registered for at least one Tech upper-division or graduate course.

Thesis or Independent Study Requirement

The candidate for the MST degree must select either a thesis or a non-thesis program under the guidance of the student's advisor and advisory committee. The thesis program involves the preparation of a thesis through experimental, theoretical, or applied research (ST 591), under the supervision of a faculty member. The candidate must satisfy the thesis requirements of the department of his/her advisor. Six credit hours will be allowed for the thesis. The Independent Study (IS) provides the candidate with an opportunity to engage in a plan of study under the supervision of NMT Faculty to (a) explore in more depth or detail an area to which the student has been introduced in previous courses or in the field of science-based education and (b) contribute to the knowledge content and/or application of the knowledge content of the selected area. An IS is intended to be a project initiated by the student and designed in conjunction with his/her advisory committee. Three credit hours will be allowed for the IS (ST 590).

Graduate Advisory Committee

Each MST student will be assigned a temporary advisor at the time of first registration. The

student will select an advisor and an advisory committee by the completion of 12 credits or within one year of first enrollment (whichever comes first). The student's academic advisor must be a regular faculty member of the Institute. The advisory committee consists of at least the academic advisor and two other members with regular faculty members not being a minority. The academic advisor serves as chair of the advisory committee. The Psychology and Education Chair and the Graduate Dean must approve the advisor and members of the advisory committee. The student should have contact with his/her advisory committee at least once a year.

Course Program

Courses to be used towards each of the graduate degrees at New Mexico Tech must meet with the prior approval of the student's advisory committee. These courses constitute the student's Course Program. The approved Course Program must be on file in the Graduate Office for full-time students no later than the end of the second semester of residency. Part-time and distance education students must formalize their course program by the time they complete 12 credits. The course program is reported on the committee report form, available online and from the Graduate Office.

Program Requirements

All incoming MST students must demonstrate competence in science and mathematics by either:

1. Completing the introductory courses:
 - ST 523, Survey of Biology (1)
 - ST 524, Survey of Chemistry (1)
 - ST 525, Survey of Geology (1)
 - ST 526, Survey of Physics (1)
 - ST 550, Mathematics for Teachers (2)

Credits are awarded for these courses but these credits DO NOT count towards the 30 credits needed for a MST Degree.

2. Passing the appropriate placement exams (see above). No credits are awarded for passing a placement exam.

These courses or the appropriate placement exams are prerequisites for most other ST courses.

Master of Science for Teacher students must take the following core of 21 credit hours that will give breadth and depth to the program:

1. All incoming students must take two technical communication courses and a computer literacy course.
 - ST 529, Research and Documentation (2)
 - ST 530, Technical Communication for Teachers (2)
 - ST 556, [Mobile Computing](#)~~Computers~~ and Science Teaching (1)
2. For comprehensiveness, MST students must take two credits in each of the following distribution areas, for a total of twelve credit hours:
 - Math (2)
 - Physics (2)
 - Chemistry (2)
 - Geology (2)
 - Biology (2)
 - Engineering/Computer Science/Economics (2)
3. For depth, MST students must take an additional six credit hours within one of the above distribution areas of the student's choice.

In addition to the core requirements above, MST students must complete:

- ST 590, Independent Study (3), or ST 591, Thesis (6)
- Additional courses to complete 30 credit hours. These courses may be chosen from MST courses or other Tech courses numbered 300 or above.

MST Courses:

All MST courses that satisfy a distribution area requirement have at least one survey course as a prerequisite. MST courses that do not apply to a distribution area require competence in basic courses in subject matter area or consent of instructor.

MST courses may not be used to fulfill the requirements of any other undergraduate or graduate degree offered by New Mexico Tech without prior approval by the chair of the department offering the degree.

Students may receive an additional credit of directed study for each course with the submission of an accepted project and paper to the professor of the respective course.

Departmental Waiver of Prerequisites and/or Distribution Area Requirement:

The MST Department Chair and the Department Chair (or his/her designee) representing a distribution area on the MST Advisory Committee must approve a request to waive a prerequisite or distribution area requirement. This request is submitted by the student and must be recommended by the advisor and have the consent of the instructor before consideration.

ST 501 Special Topics

These courses are offered on a request basis:

Charles Darwin, "The Origin of Species", and Evolution,
Vertebrate Paleontology,

[Educational Testing](#),

[Materials Science and Nanomaterials Workshop](#),

[Growth of the North American Continent](#),

[Timescapes: The Field Course](#),

[Computer Basics and MS Office](#)

[Earth Environments Through Time](#),

[Environmental Case Histories](#),

[Great Ideas In Natural History](#),

[Critical Thinking Skills](#)

ST 502D Archaeology for Teachers, 2cr

Prerequisites: ST 525/525D or departmental waiver

A general introduction to the study of the past through material remains and the relationship of archaeology to the sciences. Four major topics are covered: archaeological field and lab method and theory; human evolution; the basic structure of world prehistory; archaeological careers and application of archaeology in the public sphere. Assignments include papers, archaeological analysis problems and classroom lesson plans.

ST 503D Ancestor's Tale, 2cr

Prerequisites: ST 523/523D and ST 525/525D or departmental waiver

Evolution is a theory, a process and a narrative of biological and geological science that elucidates the history of life and its amazing diversity and abundance on Earth. *The Ancestor's Tale* is

a course that takes its name from the book (used as the text), written by noted evolutionary biologist Richard Dawkins, and is at once metaphor and narrative of life's journey through almost 4 billion years. The journey of these evolutionary pilgrims begins now, in the present, with our own species *Homo sapiens*, and moves ever deeper back through the evolutionary branchings of organisms in time. The course investigates the unity of all life on Earth through all of time.

ST ~~505~~505D, Human Evolution, 2 cr

Prerequisites: ST 523/523D or departmental waiver

We live on a planet populated by several billion members of a single species, *Homo sapiens*, different from all other species by a unique set of characters and behaviors not seen in any other animal species. This course is concerned with the origin and evolution of who we are and how we got here. The course will trace the origin of the great group to which we belong, the Primates, as well as our distant and not too distant cousins. We will review those traits that make us Primates, along with such interesting animals as the lemurs of Madagascar, the Old World Monkeys, and the Great Apes of Africa.

ST 506D, Dinosaurs and Their World, 2 cr

Prerequisites: ST 523/523D and ST 525/525D; or departmental waiver

This course means to do what its title advertises. Together, we will go on an adventure to look at dinosaurs and their world, a world at once with similarities to our own, and many differences. We will explore a world about which we know a great deal, but also a world that still has many more unanswered questions. We will take a journey back through so much time that the reality of time's distance is reduced to numbers without a sense of the actual enormity of the journey. And yet even that journey is but a small fraction of a still greater timescale of our planet and the universe.

ST 508D Worms, Bugs, and Shells, 2cr

Prerequisite: ST 523/523D or departmental waiver

This course provides an introduction to the major groups of living invertebrate animals. The vast majority of living organisms are animals and fewer than 5% of these are animals with backbones; the majority of the rest are invertebrates, the "worms, bugs and shells" of this course. This course will acquaint students with the main ideas about the classification, anatomy, evolutionary relationships, ecology, behavior, geographical distribution and other aspects of the natural history of the major groups of living invertebrates. Special emphasis will be placed on species found in New Mexico and the Southwest. Technical terminology will be kept to a minimum and the primary focus will be on big ideas.

ST 509D Human Genetics, 2cr

Prerequisites: ST 523/523D and ST550/550BD: or departmental waiver

Human genetics covers the basic principles of transmission and molecular genetics and the application of genetics to human health and reproduction. Lecture topics include forensic DNA analysis, genetic testing for diseases, cancer pre-disposition, *in vitro* fertilization, pre-implantation genetics, evolutionary medicine, and epigenetics. Bioethical issues raised by the development of new genetic tests, including whole-genome sequencing are considered. Participants are required to develop educational modules that can be used in their classes

ST ~~510~~510D Vertebrate Zoology: An Introduction to Animals with Backbones, 2cr

Prerequisites: ST 523/523D or departmental waiver

Vertebrate Zoology provides an introduction to the major groups of living vertebrate animals: fishes, amphibians, reptiles, birds and mammals. Vertebrates comprise a small fraction of all the

animals that now exist on Earth, but are the most familiar and attract the most interest, in part because we ourselves are vertebrates. Vertebrates are diverse and abundant, although an increasing number of species are endangered. This course includes the classification, anatomy, evolutionary relationships, ecology, behavior, geographical distribution and other aspects of the natural history of the world's living vertebrates. Special emphasis will be placed on species found in New Mexico and issues of threatened and endangered species, habitat destruction and protection.

ST 513, Molecular Biology Laboratory for Teachers, 2 cr

Prerequisites: ST 523/523D and ST 550/550BD; or departmental waiver

~~An introduction to the techniques used in molecular biology, including spectrophotometry, electrophoresis, gel filtration, chromatography, hydrolysis, and the analysis of biological polymers.~~

ST 517, Environmental Studies, 2 cr

Prerequisites: ST 523/523D and ST 550/550BD; or departmental waiver

This course is a study of the interrelationships of organisms with their physical and chemical environment including the biological interactions among populations, communities, ecosystems, and pollutants.

ST 518D Water as a Resource, 2cr

Prerequisites: ST 523/523D and ST 524/524D; or departmental waiver

This asynchronous web course covers one of our most precious resources in New Mexico and beyond. This course covers interesting and timely topics such as drinking water quality and supplies, water-generated energy, water conservation, desalination, ocean currents, weather patterns, water reservoirs, the hydrologic cycle, climate change, and drought, in the same flexible online format as Renewable Energy ST577d. Students view course material in weekly modules, participate in online discussions, complete two projects, and view virtual field trips. The web format allows you to view the course material whenever you want to during that module week. The scope of this course encompasses both local and global water issues and politics plus the biology and chemistry of water systems and supplies. The goal is to give a good understanding of the way water systems work and how they are connected to the other Earth systems, and to prepare students to teach water resources in their classrooms.

ST 519, Modern Genetics, 2 cr

Prerequisites: ST 523/523D and ST 550/550BD and ST 509 (recommended); or departmental waiver

This lab course is an introduction to techniques used to study Mendelian and molecular genetics, including forensic DNA.

ST ~~523~~/523D, Survey of Biology, 1 cr

A survey of life functions at the cellular level including the structure of organic molecules, membrane structure and function, energy metabolism, cellular reproduction, and gene action. Also includes an introduction to evolution and phylogenetic survey of the kingdoms of life.

ST ~~524~~/524D, Survey of Chemistry, 1 cr

This course is an introduction to basic chemical terminology and nomenclature, modern atomic and molecular theory, periodicities of chemical behavior, and the physical characteristics and isotopic stability of the elements. The student will learn how to read and write properly balanced chemical equations, make meaningful predictions based on stoichiometric relationships, identify and quantify the participants in electron and proton transfer reactions and establish a foundation for pursuing more advanced studies in the chemical, physical, material, life, earth and environmental sciences.

ST 525, Survey of Geology, 1 cr

This course covers the fundamentals of geosciences, including field-based training in how and why geology “works.” Mandatory field trips will introduce participants to the essentials of the study of Earth materials, with classroom sessions discussing the origin of the Earth, its landforms, and materials.

ST 526, Survey of Physics, 1 cr

Explore Newton’s three Laws of Motion in this laboratory course. Hands-on, class time experiments are supplemented with assigned readings. This course is not mathematically intensive.

ST 529/529D, Research and Documentation, 2 cr

Prerequisites: None

This course covers the various kinds of research (both primary and secondary) and documentation, particularly in the fields of science, including gathering and analyzing data, writing (literature reviews, reports, articles, bibliographies), and documenting correctly.

ST 530/530D, Technical Communication for Teachers, 2 cr

Prerequisites: ST 529/529D or departmental waiver

The theory and practice of writing for technology and science: lab reports, proposals, abstracts, and scientific articles. Emphasis will be on audience awareness, editing, writing, and documenting information.

ST 534D Engineering Economic Analysis, 2cr

Prerequisites: ST 550/550BD or departmental waiver

Economic principles applied to decision-making problems in mineral engineering and engineering in general. Compound interest, present worth, rate of return, depreciation, depletion, before and after tax analysis pertinent to project evaluation. *Same as ME 320.*

ST 535/535D Green Construction for Teachers, 2cr

Prerequisites: ST 550/550BD or departmental waiver

—The course covers the concepts behind sustainable construction, the history of the green construction movement, materials and processes used, regulatory and certification standards, and presents design examples. A final design project incorporates the cumulative knowledge gained in the course.

ST 536D Fundamentals of Information Technology, 2cr

Prerequisites: ST 556 or departmental waiver

This is an introductory course aimed at presenting state-of-the art information on technology and technological issues in a broad rather than detailed manner. Major issues affecting all of us and specifically the Information Technology Professionals will be discussed. Although this course is not intended to make us all experts in Information Technology (IT) it will help us understand why IT works the way it does, and give us the groundwork to be more useful IT users and partners. This course will give the student the basic understanding of IT which will help them be more comfortable with the technology around us and use it more efficiently. The student will also have a basic proficiency in an operating system and basic software applications (e.g. word processing, spreadsheets, presentation graphics, and databases).

ST 537 Supercomputer Challenge, 1cr

Prerequisite: departmental waiver

Teachers will learn how to sponsor a Supercomputing Challenge team and how to help students complete an appropriate computational science project in keeping with the Challenge mission

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statement (described at <http://www.challenge.nm.org/>). The computational project incorporates four components, Project Management, Structured Programming and Design, Mathematical and Agent Based Modeling, and Internet Research and Resources. This is a twelve month project and terminates with the final competition at LANL in May.

ST 540, Rockin' Around New Mexico, 1 cr

Prerequisite: ST 525 or departmental waiver

Explore local geology, including volcanic rocks and hazards, seismic hazards, mountain-building processes, and mineral resources. Two days of the three-day course will be spent in the field, following an introductory day comprising geologic exercises and lecture presentations. Each year, a different New Mexico community hosts this course, co-sponsored by the New Mexico Bureau of Geology.

ST 541, Geology and Mining Engineering for Teachers I, 2 cr

Prerequisites: ST 525 and ST 550/550BD; or departmental waiver

This course is a study of the principles and technology of mineral occurrence, extraction, and refining. Field trips complement lectures and laboratory experiments. Emphasis is on New Mexico base metal deposits.

ST 542D, Timescapes: Momentous, World Altering Events, 2 cr

Prerequisites: ST 525 or departmental waiver

This course is designed for science majors interested in discovering the great events occurring over the last 4.5 billion years of Earth history. Churchill said, "History is just one thing after another," but the history of planet Earth can be viewed as having been shaped by momentous, world-altering events, millions of years apart. These will form the basis of this course. The course will meet distribution requirements for science majors.

ST 543D, Forensic Geology, 2 cr

Prerequisites: ST 525 or departmental waiver

Forensic Geology is a discipline with an ever-expanding role in criminology, environment concerns, and even the war against global terror – geologists have made claims they can tell the locations of terrorist leaders by studying the rocks visible behind them in videotapes. This discipline, a specialty of the geosciences, collects and studies earth materials and their associations, including rocks, sediments, soils, water, and any man-made products that they contain, with attention toward their significance in regulatory and legal areas. The margins of Forensic Geology overlap with other sciences, including biology, chemistry, physics, anthropology, and archeology.

ST 547, Field Techniques in Geology for Teachers, 2 cr

Prerequisites: ST 525 and ST 550/550BD; or departmental waiver

This field-based course shows how geologic mapping and maps are prepared, with in-the-field exercises showing participants how geologic information is collected and plotted on geologic maps. Students will perform rock identification, review faulting and folding of rocks, and the methods used to record geologic data. Field work will be in the Socorro area, with both in-class and in-the-field assignments.

ST 548, Geology of the Southwest – National Parks and Natural Resources, 2 cr

Prerequisites: ST 525 and ST 550/550BD; or departmental waiver

This is a field-based course that involves camping, limited hiking, and visits to national parks and mine sites in the western U.S. Students will camp in areas of spectacular geologic settings. In-the-field assignments will comprise the basis for grading. the regional and local geologic settings of

national parks and mineral deposits are reviewed, and the clash between minerals utilization and natural resources occurrence are discussed.

ST 550AD, Mathematics for Teachers, 1 cr

This course is a basic survey of the principles of contemporary mathematics. The course will emphasize the algebra of sets and numbers, exponentials and logarithms, complex numbers, vectors and matrices, and applications in science for each.

ST 550BD, Mathematics for Teachers, 1 cr

Prerequisites: ST 550AD or departmental waiver

This course is a basic survey of the principles of contemporary mathematics. The course will emphasize the algebra of sets and numbers, exponentials and logarithms, complex numbers, vectors and matrices, and applications in science for each.

ST 550, Mathematics for Teachers, 2 cr

This course is a basic survey of the principles of contemporary mathematics. The course will emphasize the algebra of sets and numbers, exponentials and logarithms, complex numbers, vectors and matrices, and applications in science for each.

ST 551AD, Concepts in Mathematics for Teachers, 1 cr

Prerequisites: ST 550/550BD or departmental waiver

The development of some of the great ideas in Mathematics through history, from the concept of number to abstract mathematics, is discussed. Students develop class projects using the covered concepts and history in their own classes.

ST 551BD, Concepts in Mathematics for Teachers, 1 cr

Prerequisites: ST 551AD or departmental waiver

The development of some of the great ideas in Mathematics through history, from the concept of number to abstract mathematics, is discussed. Students develop class projects using the covered concepts and history in their own classes.

ST 552AD, Calculus on a Computer, 1 cr

Prerequisites: ST 550/550BD or departmental waiver

Students learn to use computer software to do single variable calculus. Applications and geometric understanding are emphasized. No previous calculus is required. Student versions of the software are available for purchase.

ST 552BD, Calculus on a Computer, 1 cr

Prerequisites: ST 552AD or departmental waiver

Students learn to use computer software to do single variable calculus. Applications and geometric understanding are emphasized. No previous calculus is required. Student versions of the software are available for purchase.

ST 553, Problem Solving and Recreational Mathematics, 2 cr

Prerequisites: ST 550/550BD or departmental waiver

This course covers problem solving techniques, logic and mathematical arguments, logic puzzles, word problems in algebra, games of strategy for two players, geometrical dissections, tiling puzzles, and basic combinatorics.

ST 554, Mathematical Modeling, 2 cr

Prerequisites: ST 550/550BD; or departmental waiver

Students learn the process of going from a real world problem to a mathematical model and back to an interpretation of results. Students will work in small groups on a wide variety of applications.

Projects suitable for classroom use will be developed.

ST 556, ~~Mobile Computing~~Computers and Science Teaching, 2 cr

~~This course covers the general techniques of computer maintenance and upgrading, including hardware and software. Basic use of the World Wide Web, including sites and techniques of special interest to teachers is also covered. This is a course about how to teach science and math with a mobile computer - a tablet - and what can happen when the teacher and students all have mobile computers. Topics covered include connecting to a projector or large-screen display, evaluating additional hardware, evaluating teaching apps, sharing files, and automated grading. Students make daily presentations to the class.~~

ST 557, Fractals and Chaos, 2 cr

Prerequisites: ST 550/550BD or departmental waiver

This course covers the development of the basic geometry of fractals, using both deterministic and random methods, the mathematical ideas behind chaos, the connections between the ideas of chaos and fractals, and applications.

ST 558/558D, Probability and Statistics, 2 cr

Prerequisites: ST 550/550BD or departmental waiver

This course covers techniques for the visual presentation of numerical data; descriptive statistics; introduction of sampling and statistical inference, illustrated by examples from a variety of fields.

ST 560 Space Science: Hazardous Asteroids, 2 cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

This course introduces concepts relevant to understanding small bodies in the Solar System and their effect on the near-Earth space environment. The emphasis is on processes that can threaten life on Earth, specifically, a potential asteroid collision. The goal is to expose the student to some of the basic principles of space science (gravity, kinetic energy, astronomical measurement) while using hazardous asteroids as a fun and non-intimidating context for refreshing simple math skills. The format will include lectures, laboratory exercises, and hands-on use of an optical telescope.

ST 561, Weather and Climate, 2cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

In this course, students will study the physical and chemical processes that are important for understanding weather and climate: thermodynamics and the flow of energy in the atmosphere, cloud formation and precipitation, solar and thermal radiation, the greenhouse effect, and the photochemistry of ozone.

ST 562, Radio Astronomy for Teachers, 2 cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

This course is an introduction to observational radio astronomy. It covers some general concepts of astronomy including electromagnetic radiation, motions of astronomical bodies, coordinate systems, as well as small radio telescope operation and data collection. The format will include lectures, field trips, hands on use of optical and radio telescopes, independent team research, documentation, and research presentations. Students must be willing to explore independently and work in teams. Class hours vary during the week to accommodate observing sessions.

ST 563, Optical Astronomy for Teachers, 2 cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

This course exposes the student to the techniques of optical observational astronomy. The emphasis is on correct use of digital cameras and analysis of digital images. In addition, the course covers basic aspects of finding celestial objects in the night sky. Students must be willing to explore

independently and work in teams. Class hours vary during the week to accommodate observing sessions.

ST 564/564D, Great Concepts in Physics, 2 cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

This course covers the concepts of physics from the Greeks to the present, the triumphs and questionable philosophical assumptions of the scientific method, revolutions of relativity and quantum theory. Extensive mathematical background and laboratory work are not required.

ST 565, Physics of Aviation, 2 cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

This course is a basic survey of aerodynamics with emphasis on the principles of physics that apply to flight. There is a limited use of mathematics, but nothing beyond basic algebra. The course uses the method of discovery learning to introduce the principles of physics to flight. The course is a combination of lecture, in-class exercises and take-home activities. There is one short in-class examination and a required in class presentation.

ST 567, Mission to Mars, 2cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

The STARBASE® La Luz Academy Mars Missions Flight, for fifth graders, involves students in planning and preparing for a simulated manned mission to Mars. Teachers guide their students through a series of Base Operations (including creating a mission patch, writing a saga, learning Mars facts, and designing a life support system) in the classroom and then bring students to the culminating Link-Up Day activity in the spring. The goal of the Mars Missions Flight is to increase student interest and motivation for studying science, technology, engineering, and mathematics. Participating teachers can earn graduate credit by submitting the following items: complete lesson plans developed for implementing each of the Base Operation activities in their classroom; a list of resources used in the classroom to accomplish the required Base Operations; and a lessons-learned report based on their participation in this activity.

ST 568 AFRL La Luz Summer Teacher Institute, 1cr

Prerequisites: ST526 and ST 550/550BD; or departmental waiver

This is a hands-on, inquiry-based course that focuses on science, technology, engineering, and mathematics (STEM) activities from the AFRL La Luz Academy. Students will earn one credit hour by completing a specified team STEM project, using a systems engineering approach, during the weeklong course. Opportunities to collaborate with scientists and engineers, as well as tours of AFRL facilities, will be incorporated into the course, as available. An additional credit hour is available the following summer for those students who develop and implement STEM lesson plans as Teacher Institute Fellows during the school year and present these lesson plans at the AFRL La Luz Academy Teacher Institute Symposium.

ST 569 Optics for Teachers, 2cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

This course considers the characteristics and behavior of light. Drawings and a few algebraic equations provide complementary means – concrete and abstract – for predicting the position, orientation, size and type of images created in a variety of optical instruments and natural circumstances. Participants receive an Introductory Optics System kit, and individual projects and class activities insure familiarity and the ability to adapt the kit for a range of classroom levels. The study of light introduces various “action at a distance” phenomena. While this course affirms that many observed phenomena require a considerably more sophisticated model for optics, a solid

grounding in geometric optics is sufficient for the design of state of the art instruments.

ST 570/570D ELECTRICITY, 2cr

Prerequisites: ST 526 and ST 550/550BD; or departmental waiver

Electricity and Magnetism are behind almost all modern technologies. This first course in electricity covers what you would need to teach electricity and circuits for grades 6-12. We will cover forces on charges, electric fields, voltage, current, power and electrical circuits. You will be sent a lab kit so that you can demonstrate static electric effects and build and test simple circuits. This course will introduce new mathematics (vectors) to describe electric fields and you will learn to calculate fields of multiple charges. It will also review the trigonometry and fractions that were introduced in ST550, and apply them to electric forces and circuit analysis.

ST 571/571D ELECTROMAGNETISM AND LIGHT, 2cr

Prerequisites: ST 570 or departmental waiver

This follow-on course to Electricity (ST570) introduces magnetic fields and forces and how they interact with electric currents. Dipole moment and magnetic strength are also introduced. The vector cross product is used to calculate the direction of magnetic forces. The mathematics of sine waves is reviewed and then applied to understanding wavelength, frequency, refraction, interference and diffraction. Your lab kit will allow you to demonstrate image formation by lenses and diffraction of a laser, to build a simple motor, and to build a galvanometer. This course should lead to increased confidence in physics, applied math, and basic engineering skills.

ST 572D, New Mexico Science and Scientists I, II, III, 2 cr each

Prerequisites: none

New Mexico is unique in the U.S. in its concentration of scientists and in the range of science being done here. Much of the research is on the cutting edge, be it deep-space radio astronomy, New World archeology, or the newest computer chips. New Mexico scientists are at work in universities, colleges, museums, institutes, national laboratories, the state and federal government, regional entities such as the Middle Rio Grande Conservancy, and in mining and other private industries. The course will introduce students to many of these scientists in an informal, conversational setting. This course is designed for both science and non-science majors.

Section I: Earth, Mars, and Meteors

Section II: Biology and Evolution

Section III: Energy, Environment and Materials

ST 577 Renewable Energy (extensive use of field trips), 2 cr

Prerequisites: ST 524/524D and ST 526; or departmental waiver

This is a survey course that explores the state of energy use, production, economics and environmental issues by field trips, lectures and readings. Topics explored in this course include sources of energy, impacts of energy production and use, methods of production and delivery as well as environmental, economic and political issues. Field trips will allow students to see firsthand alternative energy facilities, sites where alternative energy is in use, traditional mines and power plants. Students will meet with personnel at these facilities. A goal of the course is to enable teachers to present information in their classroom from the perspective of real experience.

ST 577D Renewable Energy (web based, no field trips), 2 cr

Prerequisites: ST 524/524D and ST 526; or departmental waiver

Energy and the energy crisis and their association with non-renewable sources are covered and renewable sources and new technologies are then covered for a contrasting perspective. Weekly course modules explain fossil fuel origins, uses, and abuses, plus the renewable energy sources wind,

solar, biomass, hydroelectric, ocean/tidal, and geothermal plus virtual field trips. The scope of this course encompasses both local and global energy issues and politics plus new technology and innovations. The goal is to give a good understanding of the alternatives to fossil fuel use and ways to reuse and conserve resources. Taking this course will prepare the student to teach energy generation and conservation in his or her own classroom.

ST 578D The Chemistry of Natural Products, 2cr

Prerequisites: ST 524/524D or departmental waiver

This course begins with an overview of organic compounds; examining each of the major functional groups. A number of different classes of naturally derived organic compounds are then considered. These include the sugars, alkaloids (opiates, nicotine, etc.), essential oils, taxanes and cannabinoids. Sulfur based compounds are also discussed. In particular, we are interested in understanding the natural sources for these compounds and methods of isolation. Additionally, we would like to understand their physiological effects, mode of action and metabolism.

ST 579D Concepts in Chemistry: Development of Atomic Theory, 2cr

Prerequisites: ST 524/524D or departmental waiver

This course examines the classic experiments in chemistry and physics that underpin our current understanding of atomic structure. We begin by examining the classification of matter, the fundamental laws of chemical combination and the development of a workable atomic theory. Then, we consider the discovery and characterization of the subatomic particles; the electron, proton and neutron. The structure of the atom is next discussed. We look at the experimental evidence for quantum physics and how it can be used to understand the electronic structure of the atom. Finally, simple bonding theories are presented.

ST 580D Introduction to Biochemistry, 2 cr.

Prerequisites: ST 524/524D or departmental waiver

This course will consider the structure and function of the four basic classes of biomolecules. These are proteins, carbohydrates, lipids and nucleic acids. A discussion of enzyme function, membrane construction, metabolism and photosynthesis will also be included. Finally, the role of nucleic acids in protein synthesis will be considered. Special topics to be taken up are vitamins, neurotransmitters and viruses.

ST 581, Directed Study, cr to be arranged

Study under the guidance of a member of the graduate faculty. In general, subject matter will supplement that available in other graduate course offerings.

ST 590, Independent Study, 3 cr

An IS provides the student with an opportunity to engage in a plan of study under the supervision of NMT Faculty to (a) explore in more depth or detail an area to which the student has been introduced in previous courses or in the field of science-based education and (b) contribute to the knowledge content and/or the application of the knowledge content of the selected area. An IS is intended to be a project initiated by the student and designed in conjunction with his/her advisory committee.

ST 591, Thesis (master's program), 6 cr

A Thesis is similar to an IS except that it normally involves research over an extended period of time and follows the guidelines of the Academic Advisor's or Research Advisor's Department. In general, the requirements for a Masters of Science for Teachers student completing a thesis are no different from the requirements for any other graduate student completing a thesis within the same department.

