

SCIENCE, TECHNOLOGY, ENGINEERING AND MATH (STEM)

STEM 230 | INTRODUCTION TO EARTH AND SPACE SCIENCE | 4 quarter hours

(Undergraduate)

This course provides an overview of the dynamic geological nature of Earth, its place in the solar system and universe, and the fundamental Earth-sky-human relationship. The format of the course is lecture, discussion, laboratory activities, and student group presentations. The course content is aligned with the Illinois Earth and Space Science Content Area Standards for educators and thus also meets the needs of secondary education majors wishing to pass the Illinois state exam for certification in earth and space science. LSP 120 or HON 180 is recommended. Formerly SDV 230.

STEM 231 | INTRODUCTION TO EARTH AND SPACE SCIENCE (WITHOUT LAB) | 4 quarter hours

(Undergraduate)

This course provides an overview of the dynamic geological nature of Earth, its place in the solar system and universe, and the fundamental Earth-sky-human relationship. Students will develop an understanding of 1) the processes that shape Earth's surface and interior over geologic time, 2) the formation, evolution, and physical properties of the sun and its planets, asteroids, and comets, 3) the physical basis for phenomena such as eclipses, phases, and seasons, 4) the formation, evolution, and properties of stars, galaxies, and the universe, 5) the historical progression of human understanding of Earth's geologic history and its place in space and time, and 6) the associated technologies that have enabled this progression. Students will encounter several historical examples that illustrate the provisional nature of science and the interaction of experiment, observation, and theory. The format of the course is lectures, discussions, laboratory activities, and student group presentations. Formerly SDV 231.

STEM 240 | SCIENCE AT THE EDGE OF SPACE | 4 quarter hours

(Undergraduate)

Earth's atmosphere and near-space environment play an increasingly important role in our lives in areas such as global warming, ozone depletion, and telecommunications. The upper atmosphere is also a starting point for human exploration of space beyond Earth. In addition to learning about Earth's upper atmosphere and beyond, students will build simple scientific experiments and launch them on a weather balloon to an altitude of 100,000 feet. Formerly SDV 240.

STEM 310 | SCIENTIFIC MODELING | 4 quarter hours

(Undergraduate)

Introduction to mathematical models used in scientific work: discrete dynamical systems, continuous models, stochastic models, Markov chains, and compartment models. Course is example-driven, with models being implemented on the computer. MAT 151 recommended. Formerly SDV 310.

MAT 150 or MAT 120 and 121 are a prerequisite for this class.

STEM 360 | SCIENTIFIC DATA ANALYSIS I | 4 quarter hours

(Undergraduate)

Descriptive methods of data analysis, probability models, statistical inferential procedures including regression and analysis of variance, especially as it relates to scientific data arising from observations and experiments. Includes the use of one or more computer statistical analysis packages. MAT 150 recommended. Formerly SDV 360.

STEM 361 | SCIENTIFIC DATA ANALYSIS II | 4 quarter hours

(Undergraduate)

Advanced statistical and data-mining methods with science-related case studies. Topics include multiple regression, logistic regression, decision trees, and naive Bayesian classification. STEM 360 recommended. Formerly SDV 361.

STEM 390 | SENIOR CAPSTONE I | 4 quarter hours

(Undergraduate)

Students will examine a scientific issue with historical or public policy significance from multiple points of view, ethical, social, as well as scientific. The topic will necessarily be one in which the interpretation and visualization of data plays a significant role in framing debate. Students will work individually or in small groups to create projects featuring the interplay of quantitative and non-quantitative approaches. STEM 361 recommended. Formerly SDV 390.

STEM 391 | SENIOR CAPSTONE II | 4 quarter hours

(Undergraduate)

Students work on a quarter-length project whose end product is either a detailed mathematical analysis or a visualization of several large scientific data sets. The project will integrate a few of the science topics done in SDV 390 with data analysis and visualization. Collaborations with researchers and organizations such as educational institutions and museums are especially encouraged.

STEM 399 | INDEPENDENT STUDY | 1-6 quarter hours

(Undergraduate)

Formerly SDV 399. (variable credit)

STEM 405 | ECOLOGY FOR TEACHERS | 4 quarter hours

(Graduate)

This course provides a broad survey of ecological principles through laboratory and field investigations appropriate in an urban setting. The course focus is on the use of local environments to promote awareness of and appreciation for the complexity, diversity and structure of the natural world while developing skills in hypothesis testing, experimental design and data analysis. Formerly SDV 405.

STEM 409 | MATHEMATICAL METHODS FOR MIDDLE SCHOOL SCIENCE TEACHERS | 4 quarter hours

(Graduate)

This course develops the mathematical methods that support the teaching of science at the middle school level: proportional reasoning, rates, exponents and scientific notation, graphing, and elementary modeling. The course incorporates the use of technology such as calculators and spreadsheets for scientific analysis.

STEM 410 | TOPICS FOR TEACHERS | 4 quarter hours

(Graduate)

Selected topics in science and science education. Formerly SDV 410. (variable credit)

STEM 411 | FOUNDATIONS OF PHYSICAL SCIENCE I | 4 quarter hours (Graduate)

This course explores the nature of scientific inquiry, using a historical case study of the development of classical physics in the work of Copernicus, Brahe, Kepler, Galileo, and Newton. It explores the roles of observation, classification, experiments, theory, and mathematical models in science as well as the character of scientific change. Formerly SDV 411.

STEM 412 | FOUNDATIONS OF PHYSICAL SCIENCE II | 4 quarter hours (Graduate)

Fundamental concepts of physics examined quantitatively: velocity, acceleration, surface area, volume, density. Elementary modeling for data analysis, including spreadsheets and data acquisition software. Scaling of physical quantities. Formerly SDV 412.

STEM 413 | LIGHT AND WAVES | 4 quarter hours (Graduate)

Fundamentals of wave motion with application to light, water, and sound. Teachers are introduced to a variety of physical science topics in the curriculum as well as an example of the extraordinary unifying power of physics concepts such as waves. Formerly SDV 413.

STEM 420 | CHEMISTRY FOR TEACHERS | 4 quarter hours (Graduate)

The structure and composition of matter. Physical and chemical change, examined from conceptual viewpoints which include atomic theory, stoichiometry, periodicity, bonding, equilibrium, thermodynamics and kinetics. Formerly SDV 420.

STEM 421 | CELL BIOLOGY FOR TEACHERS | 4 quarter hours (Graduate)

This course focuses on the chemical and cellular nature of living organisms, cell structure and function, and heredity. Enzymes, the movement of materials across membranes, photosynthesis, respiration, cell division, and basic genetics. Formerly SDV 421.

STEM 422 | EVOLUTION AND DIVERSITY FOR TEACHERS | 4 quarter hours (Graduate)

This course explores the subjects of biological evolution and species diversity. Topics covered include the history of our understandings of the origin and nature of species, mechanisms that produce evolutionary change, geographic variation and speciation, current theories and evidence of life's origin and the history of life on earth. Controversies in biological evolution, both scientific and cultural will be discussed. Formerly SDV 422.

STEM 423 | PLANT AND ANIMAL BIOLOGY FOR TEACHERS | 4 quarter hours (Graduate)

This course focuses on the structure and function of living organisms. Students will investigate how different organisms solve common problems of food acquisition, digestion and the distribution of nutrients, waste removal, gas exchange, maintenance of homeostasis and reproduction. While this course examines the diversity of living forms, there is a special emphasis on the structure and function of the human body. Formerly SDV 423.

STEM 425 | TOPICS IN LIFE SCIENCES FOR TEACHERS | 4 quarter hours (Graduate)

Diverse topics in Life Sciences appropriate for middle school and high school students.

STEM 430 | ASTROBIOLOGY FOR TEACHERS | 4 quarter hours (Graduate)

Astrobiology focuses on basic questions such as: How does life of any kind begin and develop? Does life exist elsewhere in the universe? What are the environmental limits for life? What is the future of life on the earth and beyond? The course reviews the origin and evolution of life on Earth and goes on to examine the prospects of habitats capable of supporting life in our solar system, and the potential for planets and life to exist orbiting other stars. Students will work with NASA remote sensing data of the earth, the other planets, and their moons. Formerly SDV 430.

STEM 431 | ASTRONOMY FOR TEACHERS | 4 quarter hours (Graduate)

This course emphasizes astronomy particularly relevant to the middle school science curriculum. The structure of the solar system, motion of the sun, phases of the moon, familiarity with the night sky, stellar structure and evolution, galaxies, and introduction to cosmology. Students will be familiarized with student reading materials particularly appropriate for the combined teaching of science and reading. Students will make observations and use sky simulation software. Formerly SDV 431.

STEM 432 | GEOLOGY AND PLANETARY SCIENCE FOR TEACHERS | 4 quarter hours (Graduate)

Planetary formation and evolution. Plate tectonics and the rock cycle, including volcanism, planetary interiors, weathering, sedimentation, and metamorphism. Formerly SDV 432.

STEM 440 | HEAT AND ENERGY FOR TEACHERS | 4 quarter hours (Graduate)

Concept of energy, its nature, forms, and transfer with applications to physical science and earth science. Definition of energy in terms of work, potential and kinetic energy, conservation of energy, thermal energy, solar energy, energy in earth systems. Formerly SDV 440.

STEM 441 | WEATHER AND CLIMATE FOR TEACHERS | 4 quarter hours (Graduate)

Basic physical and chemical processes that shape weather and climate. Solar radiation and the seasons, composition and structure of the atmosphere, atmospheric processes, human effects, historical and contemporary climate change. This course emphasizes quantitative methods. Formerly SDV 441.

STEM 442 | ENVIRONMENTAL SCIENCE FOR TEACHERS | 4 quarter hours (Graduate)

A general introduction to the scientific background of some of the most important environmental problems facing urban areas, the nation and the world. Population dynamics, water and energy resources, ecosystem degradation, extinction and the loss of biodiversity, and climate change. The course will include a field observation and experiment.

STEM 461 | NUMBERS AND OPERATIONS FOR ELEMENTARY MATHEMATICS TEACHERS I | 4 quarter hours (Graduate)

This course is the first of a three course sequence that develops teachers' conceptual understanding of whole numbers, integers, rational numbers, and real numbers in order for the teachers to take on the role of being a math teaching specialist in their school. The courses emphasize problem solving, cognitive demand, equitable access, and the development of student agency. Topics of the first quarter include whole numbers, the laws of arithmetic, place value, models for multiplication, models for division (inverse multiplication model, measurement model, and partitive model).

STEM 462 | NUMBERS AND OPERATIONS FOR ELEMENTARY MATHEMATICS TEACHERS II | 4 quarter hours**(Graduate)**

This course is the second of a three course sequence that develops teachers' conceptual understanding of whole numbers, integers, rational numbers, and real numbers in order for the teachers to take on the role of being a math teaching specialist in their school. The courses emphasize problem solving, cognitive demand, equitable access, and the development of student agency. Topics include rational numbers, different models for fractions including part-to-part, part-to-whole, and area, operations with fractions.

STEM 461 (or instructor permission) is a prerequisite for this class.

STEM 463 | NUMBERS AND OPERATIONS FOR ELEMENTARY MATHEMATICS TEACHERS III | 4 quarter hours**(Graduate)**

This course is the third of a three course sequence that develops teachers' conceptual understanding of whole numbers, integers, rational numbers, and real numbers in order for the teachers to take on the role of being a math teaching specialist in their school. The courses emphasize problem solving, cognitive demand, equitable access, and the development of student agency. Topics include factors and multiples of whole numbers, greatest common divisor and least common multiple of whole numbers, prime factorization, decimal representations of fractions, use of ratios and proportions to represent and analyze quantitative relationships, percentages and scaling.

STEM 462 (or instructor permission) is a prerequisite for this class.

STEM 464 | GEOMETRY FOR ELEMENTARY MATHEMATICS TEACHERS I | 4 quarter hours**(Graduate)**

This course launches a two course sequence that develops teachers' conceptual understanding of geometry in order for the teachers to take on the role of being a math teaching specialist in their school. Teachers will gain fluency with geometric terms and concepts and think strategically about geometric problem solving. Topics include the foundations of geometry, and its system of definitions, axioms, and basic theorems; the classification of shapes; transformations of the plane, including reflections, rotations, and translations.

STEM 465 | GEOMETRY FOR ELEMENTARY MATHEMATICS TEACHERS II | 4 quarter hours**(Graduate)**

This course is the second of a two course sequence that develops teachers' conceptual understanding of geometry in order for the teachers to take on the role of being a math teaching specialist in their school. Teachers will gain fluency with geometric terms and concepts and think strategically about geometric problem solving. Topics include geometric measurement and its applications, including length, perimeter, and area; transformations of the plane including dilations and similitudes; the Pythagorean Theorem.

STEM 464 (or instructor permission) is a prerequisite for this class.

STEM 466 | INTEGRATING NUMBER AND OPERATIONS AND ALGEBRA FOR ELEMENTARY MATHEMATICS TEACHERS | 4 quarter hours**(Graduate)**

This course draws on the context and examples from previous courses in number and operations and geometry to develop teachers' understanding of algebraic reasoning. Topics include generalizing and analyzing patterns, creating and interpreting expressions and equations using variables, and solving real world problems that model continuous situations.

STEM 463 and STEM 464, or instructor permission, are prerequisites for this class.

STEM 467 | LEADERSHIP IN ELEMENTARY MATHEMATICS EDUCATION | 4 quarter hours**(Graduate)**

This course develops the aptitudes and leadership skills required for elementary school mathematics teachers to act as math teaching specialists in their school. The course emphasizes advocating for high-quality mathematics instruction, enhancing collaboration in mathematics within and across grade levels, and supporting professional learning in high-quality mathematics instruction.

At least three courses from the following list are prerequisites for this class: STEM 461, STEM 462, STEM 463, STEM 464, STEM 465, STEM 466.

STEM 481 | ALGEBRA FOR MIDDLE SCHOOL MATH TEACHERS I | 4 quarter hours**(Graduate)**

This course is the first of a three course sequence that provides teachers with a deep, conceptual understanding of the first year of secondary level Algebra to prepare them to teach secondary level Algebra to middle school students. These courses heavily emphasize problem solving and integrate pedagogical content knowledge and research on student preconceptions and growth. The first quarter's topics include: variables, expressions, identities, the Distributive Law and its consequences, the nature of solving equations, equivalent equations, solving of linear equations and inequalities, slope and rate of change, equations of lines, parallel and perpendicular lines.

STEM 482 | ALGEBRA FOR MIDDLE SCHOOL MATH TEACHERS II | 4 quarter hours**(Graduate)**

This course is the second of a three course sequence that provides teachers with a deep, conceptual understanding of the first year of secondary level Algebra to prepare them to teach secondary level Algebra to middle school students. These courses heavily emphasize problem solving and integrate pedagogical content knowledge and research on student preconceptions and growth. The second quarter's topics include: definition of a mathematical function, domains of functions, graphs of functions, piecewise defined functions, systems of linear equations, exponential functions, function transformations, absolute value inequalities, and systems of inequalities in the plane.

STEM 481 (or instructor permission) is a prerequisite for this class.

STEM 483 | ALGEBRA FOR MIDDLE SCHOOL MATH TEACHERS III | 4 quarter hours**(Graduate)**

This course is the first of a three course sequence that provides teachers with a deep, conceptual understanding of the first year of secondary level Algebra to prepare them to teach secondary level Algebra to middle school students. These courses heavily emphasize problem solving and integrate pedagogical content knowledge and research on student preconceptions and growth. The third quarter's topics include: polynomial functions, the graphs of polynomial functions including their end behavior, quadratic functions, vertex form for quadratic functions, quadratic equations, arithmetic and geometric sequences.

STEM 482 (or instructor permission) is a prerequisite for this class.

STEM 490 | SCIENCE TEACHING CAPSTONE | 4 quarter hours**(Graduate)**

Teachers will further examine current research on how students at the middle school level learn science concepts and conduct an action research project involving science teaching. STEM 405, STEM 412, STEM 413 and six content courses recommended. Formerly SDV 490.

STEM 698 | TOPICS FOR MATHEMATICS AND SCIENCE TEACHERS | 1-4

quarter hours

(Graduate)

Diverse topics in teaching and learning of mathematics and science. These courses are designed for current and future teachers. (variable credit)

STEM 699 | INDEPENDENT STUDY | 4 quarter hours

(Graduate)

Formerly SDV 699. (variable credit)