

# SCIENCE, TECH, ENGR, AND MATH (STEM)

## Science, Technology, Engineering, and Math Graduate Courses

### STEM 8020 MATHEMATICAL MODELING FOR SECONDARY TEACHERS (3 credits)

This course will examine the mathematics underlying several problem situations found in a variety of societal settings. Mathematical models of problems in current literature will be examined and other models will be constructed based on data collected through course activities. Topics relevant to these problems will include function analysis, algebra, geometry, trigonometry and probability and statistics. The role of mathematics in society will be evidenced as problems considered will be timely and sources utilized will include original documentation whenever possible (i.e. recent research reports, government reports and publications). (Cross-listed with MTCH 8020).

### STEM 8030 EVOLUTION: FROM GENOMES TO ECOSYSTEMS (3 credits)

This course will prepare students to evaluate and discuss evolution as an underlying concept in all of biology. Further, it will provide a comprehensive overview of evolutionary processes related to the evolution of genomes, development, physiology, morphology, behavior, and ecosystems. (Cross-listed with BIOL 8030).

**Prerequisite(s):** Courses for graduate admission or equivalent, or with permission of instructor.

### STEM 8040 TOPICS IN MATHEMATICAL COMPUTING (3 credits)

This course focuses on the current state-of-the-art technology that is either designed for or is uniquely suitable for teaching mathematics. (Cross-listed with MTCH 8040)

**Prerequisite(s):** MATH 2200 or equivalent or approval of instructor.

### STEM 8050 DATA-DRIVEN DECISION MAKING FOR EDUCATORS (3 credits)

This course provides graduate students with hands-on experiences that model data-driven decision making for educational success in today's classroom. Students will learn how to create valid and reliable assessments; interpret standardized test data; build data models that identify student, classroom, program, and school needs; and in general, to systematically enhance educational decision making from a base of carefully collected information. Graduate students will also explore data collection and analysis strategies associated with technologies such as cloud computing, tablet computers, and smart phones. In addition, they will experience data-driven decision-making models that can be integrated into student lessons to not only teach more effectively with data-driven decisions, but also to help teach students about data-driven decision-making. The course will use real data sets and cases, in interesting, hands on and technology-rich activities, to help educators learn how to find the "educational story" represented by a set of carefully collected data points. (Cross-listed with TED 8050).

**Prerequisite(s):** Graduate Standing.

### STEM 8170 ECOSYSTEM ANALYSIS FOR EDUCATORS (3 credits)

This course is designed for education graduate students who wish to take a field-based biology course that uses an interdisciplinary approach to understanding the ecosystem of the tallgrass prairie. This course engages graduate students in methods reflecting multidisciplinary STEM strategies (e.g. scientific inquiry, modeling, geographic information system mapping, etc.) associated with research taking place at the Glacier Creek Preserve. Graduate students completing this course will develop advanced knowledge of ecology, restoration ecology, and monitoring of prairie habitat restoration. Graduate students will focus on the technical, biogeochemical, ecological and cultural aspects of analyzing and restoring the prairie ecosystem and its various habitats. (Cross-listed with BIOL 8170)

**Prerequisite(s):** Graduate Standing or Permission from the Instructor.

### STEM 8300 STEM TEACHING METHODS FOR DEVICE DESIGN (3 credits)

STEM Teaching in Biomechanics focuses on principles in teaching including teaching models (Problem-Based, Team-Based, Inquiry-Based teaching), student assessment, classroom logistics/organization, and device design through a mentorship project. (Cross-listed with BMKI 9301, BMCH 8300).

### STEM 8370 DATA VISUALIZATION AND MODELING FOR EDUCATORS (3 credits)

In the growing context of data informed decisions there is a need to answer "what if" questions in a variety of decision-making situations, as well as to display data both visually and interactively. This course will provide foundational skills in data visualization and modeling for educational decision making and instruction. It draws upon key fundamentals in data visualization (representing data trends visually) as well as key strategies in data modeling (interactive representations to explore possible outcomes). The course also explores the use of visualization and modeling technologies as well as assisting student learning with these tools. (Cross-listed with TED 8370).

### STEM 8410 IMPROVEMENT OF INSTRUCTION: SPECIAL TOPICS (3 credits)

This course provides an in-depth study of instructional theory, research, and methodology designed to extend teachers' professional knowledge base and enhance their pedagogical skills. When offered, a course may be limited to improvement of instruction in a selected subject area. (Cross-listed with TED 8410).

### STEM 8420 TRENDS AND TEACHING STRATEGIES IN SCIENCE EDUCATION (3 credits)

This course is designed for the graduate candidate in the Department of Teacher Education whose study program emphasis is in the area of science education. The course will describe and analyze past and present trends in science education, including curricula, teaching-learning strategies, the laboratory and instructional materials. The course focus will be K-12 and as such is meant to serve both elementary and secondary graduate candidates. (Cross-listed with TED 8420).

**Prerequisite(s):** Graduate standing.

### STEM 8430 SCHOOL CURRICULUM PLANNING (3 credits)

This course is designed to provide advanced degree candidates with an understanding of the theory, principles, and practices utilized in curriculum planning in American schools. This course focuses on the principles and practices of effective curriculum planning and teachers' part in these processes as curriculum developers. (Cross-listed with TED 8430).

**STEM 8450 BIOLOGY EDUCATION RESEARCH METHODS (3 credits)**

In this course, students will learn the methods of conducting pedagogical research in Biology, understand how people learn the concepts, practices, and ways of thinking in science and engineering; understand the nature and development of expertise in a discipline; help identify and measure appropriate learning objectives and instructional approaches that advance students toward those objectives; contribute to the knowledge base in a way that can guide the translation of statistical findings to classroom practice; and identify approaches to make science and engineering education broad and inclusive. Students will work with live data sets to evaluate effective pedagogical approaches in the biology classroom of various audiences (K-16).

**STEM 8510 AEROSPACE EDUCATION WORKSHOP (3 credits)**

This course will focus on aviation and space education and its impact on society. It will seek to communicate knowledge, impart skill, and develop attitudes relative to the scientific, engineering and technical as well as the social, economic and political aspects of aviation and space flight efforts. (Cross-listed with TED 8510, AVN 8510)

**Prerequisite(s):** Graduate standing.

**STEM 8530 INSTRUCTIONAL DESIGN STRATEGIES FOR STEAM EDUCATORS (3 credits)**

This course is designed to provide graduate candidates with the opportunity to enhance interdisciplinary instructional strategies, curricular understanding, and lesson preparation in the areas of science, technology, engineering, the arts, and mathematics (STEAM) through analysis and reflective practices in STEAM. This course provides hands-on experiences that model STEAM integration techniques, including how to effectively engage with community agencies and partners to bring STEAM into the classroom. This course emphasizes not only the technical aspects of STEM, but also the creativity and innovation that arts integration can add to enhance STEM curriculum. Teacher professionals will be provided with tools, resources, and strategies to help them explore and enhance current, new, or supplemental curriculum activities that will enhance STEAM learning, student engagement, and motivation. (Cross-listed with TED 8530)

**Prerequisite(s):** This course includes both teacher education and STEAM related topics and therefore fits into both TED and STEM program coursework.

**STEM 8810 STEM IN EARLY CHILDHOOD EDUCATION: CURRICULUM AND RESEARCH (3 credits)**

This course will explore theoretical and foundational pedagogical strategies in early childhood education used to deliver integrative STEM education in the preK-12 setting. In order to understand the research and practice of STEM disciplines in preK-12, it is necessary to examine the social, cultural, political, and functional aspects that influence them. Candidates will investigate the nature of STEM education, Early Childhood Education (ECE) pedagogy and perspectives of learning, content knowledge and dispositions for educators of STEM topics, and issues of access and equity for STEM education through literature, discussion, and practice. This course includes a community outreach component in which candidates will use qualitative methods to observe class topics in public settings. (Cross-listed with TED 8810)

**Prerequisite(s):** Graduate status

**STEM 8840 ENGINEERING EDUCATION EXTERNSHIP (3 credits)**

This graduate course will address the best practice of effective teaching and learning in Engineering Education through professional collaboration between K-12 STEM (Science, Technology, Engineering, and Mathematics) teachers and practicing engineering professionals. K-12 STEM teachers, as graduate students in the course, will learn about and address real-world applications and career opportunities in STEM education through the externship. K-12 STEM teachers will research and develop authentic, experiential learning opportunities and projects for the classroom through course supports associated with lecture, discussion, and partnerships with practicing engineering professionals. The externship will be integral to the K-12 STEM teachers' experiences and work in this course, as the course models effective professional collaboration founded on experience, knowledge, and skills to achieve a curriculum enhancement goal. (Cross-listed with TED 8840).

**Prerequisite(s):** Graduate status. Not open to non-degree graduate students.

**STEM 8860 INVENTION & INNOVATION IN ENGINEERING EDUCATION (3 credits)**

This course will address emerging trends in STEM education for in-service K-12 STEM teachers with a focus on the use of engineering education practices in teaching and learning content. STEM teachers will receive applicable, hands-on, classroom-ready experiences through lecture, professional instruction, and projects that will emphasize product design and creation through the Engineering Design Process. The Engineering Design Process will be central to the candidates' experiences in this course and will be used by the candidates to develop curriculum utilizing emerging trends to supplement current course content and standards. Interdisciplinary planning will be central to the course. (Cross-listed with TED 8860)

**Prerequisite(s):** Graduate status is required.

**STEM 8910 CAPSTONE IN CS EDUCATION (3 credits)**

This course will allow graduate students, as an individual or as part of a group, to study and analyze specific problems related to teaching computing in schools. Projects will be concerned with the curriculum and/or instruction of computing and should address a broad scope of application rather than a specific level. (Cross-listed with CSTE 8910).

**Prerequisite(s):** Student must have completed 21 hours in the Masters of CS Education program.