
SEM Science, Technology, Engineering, and Mathematics

SEM 110 INTRODUCTION TO STEM EDUCATION. (2)

Through campus and school-based experiences, students will learn how to engage adolescents in learning mathematics, science, computer science, and engineering. This course will introduce the foundations of STEM Education, learning environments, curriculum and instruction, standards and assessment, as well as contemporary issues related to the field. The roles, responsibilities and daily life of teachers, schools and students will be examined. This course includes 30 hours of experience in the field.

SEM 328 TEACHING SCIENCE IN THE ELEMENTARY SCHOOL. (3)

A critical analysis of a variety of objectives, instructional materials and evaluation techniques for teaching elementary school science, with a special emphasis on grades K-4. Consideration will be given to addressing the individual needs of a diverse student population. Twenty hours of field experience are required in conjunction with EDC 322. Prereq: Admission to TEP and 12 hours of science. Coreq: EDC 322.

SEM 337 TEACHING MATHEMATICS IN ELEMENTARY SCHOOLS. (3)

Fundamental concepts of numbers, their relationships, geometry and other mathematics topics for children of grades K-4. Emphasis on use of concrete materials and the development of language, appropriate learning experiences, computational skills, and problem-solving abilities. Prereq: Admission to TEP and MA 202. Coreq: EDC 322.

SEM 345 METHODS OF TEACHING MIDDLE LEVEL MATHEMATICS. (3)

A study of theoretical models and methodological strategies for teaching arithmetic, informal geometry, and introductory algebra at the middle school level. The course will include a critical analysis of a variety of objectives, instructional materials and strategies, and evaluation techniques. Consideration will be given to addressing the individual needs of a diverse student population. This course is in conjunction with a four-week field experience, consisting of 2 two-week placements in the candidate's areas of content concentration. Prereq: Admission to Teacher Education, 12 hours in Mathematics, or permission of instructor.

SEM 348 METHODS OF TEACHING MIDDLE LEVEL SCIENCE. (3)

A study of theoretical models and methodological strategies for teaching science at the middle school level. This course will include a critical analysis of a variety of objectives, instructional materials and strategies, and evaluation techniques for middle school science. Special needs of individuals in a diverse middle school population are emphasized. This course is in conjunction with a four-week field experience, consisting of 2 two-week placements in the candidate's areas of content concentration. Prereq: Admission to Teacher Education, 12 hours in science, or permission of instructor.

SEM 421 STEM EDUCATION METHODS I. (3)

This course is intended to help future STEM Education teachers build a theoretical background and develop the practical skills needed to begin to develop themselves as effective teachers in the secondary classroom. Students will be introduced to, and gain hands-on experience with a variety of instructional materials appropriate for teaching STEM Education at the secondary level. Students are encouraged to be creative and reflective in developing, implementing, and evaluating practices associated with teaching STEM concepts and skills. A strong emphasis is placed upon helping students to develop an understanding of the processes of inquiry teaching, the processes of science and mathematics, as well as a deep conceptual understanding of their respective content area(s). This is part I of a two course sequence. This course requires a minimum of 100 hours of observation. Prereq: EDP 202, SEM 110, Admission into STEM PLUS Program.

SEM 422 STEM EDUCATION METHODS II. (3)

This course, the second in a two course series, is intended to further develop the practical skills needed to develop effective STEM Education teachers in the secondary classroom. Students will build upon the knowledge and experience they gained in SEM 421 by delving deeper into students' content area(s) through field experiences, implementation of a variety of instructional materials, and development of curricula appropriate for teaching STEM Education at the secondary level. Students are encouraged to be creative and reflective in developing, implementing, and evaluating practices associated with teaching STEM concepts and skills. A strong emphasis is placed upon helping students to develop an understanding of the processes of inquiry teaching, the processes of science and mathematics, as well as a deep conceptual understanding of their respective content area(s). This is part II of a two course sequence. This course requires a minimum of 100 hours of observation. Prereq: SEM 421 and admission into the STEM PLUS Program.

SEM Science, Technology, Engineering, and Mathematics

SEM 423 ASSESSMENT IN STEM EDUCATION. (2)

The work in this course will help prepare future STEM teachers to create, examine, analyze, and critically utilize a variety of assessments found in K12 education. Specific focus will be given to present day assessment issues and will also include the following interconnected components in relation to assessment: equity (high expectations and strong support for all students); curriculum (coherent, focused, comprehensive, and culturally inclusive); teaching (focus on understanding what students know and need to learn); learning (active construction of new knowledge) and technology (incorporation of technological influences in the teaching-learning process). Prereq: Admission into STEM PLUS Program. Taken concurrently with SEM 435.

SEM 435 STEM STUDENT TEACHING IN THE SECONDARY SCHOOL. (10)

SEM 435 is a ten credit hour course taken concurrently with student teaching. The purpose of student teaching is to help student teachers continue to develop their knowledge, strategies, and the skills necessary in order to become successful and productive secondary teachers capable of being a leader in the profession. With the support of cooperating teachers in area schools, the course instructor, and university field supervisors, student teachers will apply the theories, methods, and techniques they have learned in the past in addition to what they will learn during their concurrent student teaching experiences. Prereq: Consent of Program Advisor and admission into STEM PLUS Program.

SEM 445 APPLICATIONS OF TEACHING MIDDLE LEVEL MATH. (3)

A study of theoretical models and methodological strategies for teaching mathematics at the middle school level. The course will include a critical analysis of equity issues in middle school mathematics, using manipulatives across the curriculum, and strategies for promoting adolescents' curiosity in mathematics. This course is in conjunction with an eight-week field experience. Prereq: SEM 345 or permission of instructor.

SEM 448 APPLICATIONS OF TEACHING MIDDLE LEVEL SCIENCE. (3)

A study of applied models and methodological strategies for teaching science at the middle school level. This course will include applications such as project based learning, engineering design-based science, interdisciplinary science, and other innovative methods for applying national and state science standards to real-world contexts. Special emphasis will be given to lesson study and peer teaching and evaluation. This course is in conjunction with an eight-week field experience. Prereq: SEM 348 or permission of instructor.

SEM 504 DESIGNING PROJECT-BASED ENVIRONMENTS IN STEM EDUCATION. (3)

SEM 504 will give students the opportunity to explore STEM contents, technologies, instructional strategies, and assessments necessary in designing and developing a research-based, interdisciplinary, project-enhanced environment. In SEM 504 students will experience, evaluate, and design interdisciplinary, project-enhanced environments within STEM classrooms. Although this course is designed as a distance course, there are some required face to face meetings.

#SEM 521 FOUNDATIONS IN STEM TEACHING. (1-5)

This course is intended to help future mathematics/science teachers build a theoretical background and gain the practical skills needed to begin to develop themselves as effective teachers in secondary classrooms. Students will be introduced to, and gain hands-on experience with a variety of instructional materials appropriate for teaching mathematics/science at the secondary level. Students are encouraged to be creative and reflective in developing, implementing, and evaluating practices associated with teaching concepts and skills. A strong emphasis is placed upon helping students to formulate an understanding of how to integrate the mathematical and scientific practices with the core ideas of the disciplines to develop deep conceptual understanding. The experiences in this course are designed to prepare teachers who will work among diverse populations and constantly be in tune with best practices and their implementation as a way to improve education in Kentucky and beyond. The course will focus on developing a number of general pedagogical skills; the integration of math and science candidates into this single class will enrich the conversations around such topics. SEM 521 will be taught as a hybrid course, with weekly face-to-face meetings paired with online modules that can be completed asynchronously. The course will have an accompanying university research/industry externship/informal STEM education experience associated with it for variable hours and variable credits. Prereq: Admission to the TEP and either the B.S. in STEM Education or the M.A.T. in Secondary STEM Education (Initial Certification – Secondary Ed) program.

SEM Science, Technology, Engineering, and Mathematics

SEM 575 SEE BLUE MATHEMATICS CLINIC. (3)

This course focuses on clinical techniques for working with K-12 students who are struggling and/or have disabilities in learning mathematics. It is a course designed to develop both theoretical understandings and operational skills in working with students who struggle in mathematics. Classroom applications of the techniques are discussed. This course is a combination of lecture and application with a student client.

SEM 603 CURRICULUM AND INSTRUCTION IN STEM EDUCATION. (3)

This course introduces the fundamental issues related to curriculum and instruction in STEM programs. Major topics addressed will include (but will not be limited to), defining STEM education, its curricula, purposes, and past and present social and political influences affecting the development and focus of STEM education. Additional discussion will address the stakeholders of STEM education that participate in the development, testing, implementation, and assessment of STEM curricula. A major focus of the course will be on the review of selected STEM curricular programs that reflect research-based “best practices” in STEM education.

SEM 604 HISTORY OF STEM EDUCATION. (3)

The History of STEM Education course will begin with researching the background and development of each individual component of STEM (i.e., Science, Technology, Engineering, and Mathematics) Education. This will follow with a historical comparison of these components highlighting their similarities as well as their differences. The course will conclude with a study of the entity, STEM Education, from the early 19th century America to the present focusing on reports and documents that have connected the Science, Technology, Engineering, and Mathematics disciplines and shaped current research and reform efforts.

SEM 610 TEACHER LEADERSHIP IN STEM EDUCATION. (3)

This course introduces fundamental issues related to classroom research, especially through the lens of action research, and what it means to be a teacher leader in the areas of STEM. Practical application will be the primary focus simultaneously with learning and learning to lead. Collaboration and group work is a hallmark of action research; students in this course will demonstrate their abilities to design, diagnose, plan, implement, observe, and reflect in cooperation with classmates. The various roles and skills necessary to be an effective researcher will be discussed, as well as important issues related to empowerment, contextualization, ethical considerations, and validity. In addition, students will examine action research through the lens of innovation and their role as a future teacher leader.

SEM 613 EFFECTIVE USE OF TECHNOLOGY FOR MODELING-BASED INQUIRY IN STEM EDUCATION. (3)

This course is designed to teach effective uses of educational technologies towards engagement in modeling-based inquiry in STEM Education. Students will learn the key components of facilitating modeling-based inquiry through their own building of accurate conceptual models of explanations of key STEM theories and underlying concepts. Utilizing technologies implemented in authentic STEM practice, students will learn how to facilitate pupils’ use of technologies to allow them to make controlled observations, analyze data, recognize patterns, propose and revise their models of explanation, and communicate their models to their peers. Prereq: EDC 317 and/or EDC 607 or its equivalent or permission of instructor.

SEM 620 EQUITY IN STEM EDUCATION. (3)

This course is a seminar designed to study equity issues in the teaching and learning of STEM disciplines in P-20 education. A primary focus will be on enhancing teachers’ ability to use research and reflection for learning and leading. Throughout the course the relationship between theory and practice will be emphasized in an attempt to understand some of the complexities and challenges in addressing issues of equity in mathematics learning and teaching. Prereq: Graduate standing.

SEM 631 MATHEMATICS PEDAGOGY IN THE SECONDARY SCHOOL. (0-3)

Through campus and school-based experiences, students will learn how to engage young people in learning mathematics and how to make decisions about planning instruction and develop assessment based on a sound knowledge base for applying content, materials, and methods (including educational technology) appropriate for high school students. May be repeated to a maximum of three credits. Lecture, 1-3 hours; laboratory, 3-6 hours per week. Prereq: Admission to the M.A./M.S. in Education (Initial Certification Option-Secondary Education).

SEM 634 SCIENCE PEDAGOGY IN THE SECONDARY SCHOOL. (0-3)

Through campus and school-based experiences, students will learn how to engage young people in learning science and how to make decisions about planning instruction and develop assessment based on a sound knowledge base for applying content, materials, and methods (including educational technology) appropriate for high school students. May be repeated to a maximum of three credits. Lecture, 1-3 hours; laboratory, 3-6 hours per week. Prereq: Admission to the M.A./M.S. in Education (Initial Certification Option-Secondary Education).

SEM Science, Technology, Engineering, and Mathematics

SEM 670 ADVANCED STUDY IN THE TEACHING OF ELEMENTARY SCHOOL MATHEMATICS. (3)

New developments in modern elementary mathematics for teachers in the elementary schools will be reviewed. Special emphasis will be given to a study of new teaching methods, application of published research, techniques and trends in mathematics in the elementary school. Prereq: Graduate standing.

SEM 674 ADVANCED STUDIES IN TEACHING ELEMENTARY SCHOOL SCIENCE. (3)

An advanced course for classroom teachers that focuses on implementation of instructional strategies and assessments for teaching elementary science. A review of contemporary research in teaching and learning science will be closely related to classroom instruction. Specific focus will be given to technology integration, assessment, and addressing the needs of diverse student populations. Prereq: Graduate standing.

SEM 701 HISTORY OF MATHEMATICS EDUCATION. (3)

A study of mathematics education from early 19th century America to the present focusing on forces that connected mathematics, psychology, psychometrics, sociology, and technology. Prereq: EPE 651 or permission of the instructor.

SEM 702 THEORETICAL FOUNDATIONS OF MATHEMATICS EDUCATION. (3)

A survey of constructivism, cognitive science, and sociological and anthropological perspectives as fundamental theories for mathematical learning, and an overview of research context where these theories guide inquiries. Prereq: EDP 610 (Theories of Learning) or consent of instructor. Many concepts and theories in SEM 702 are related to learning theories. Past students felt better prepared for SEM 702 after taking EDP 610.

SEM 703 ADVANCED RESEARCH IN MATHEMATICS EDUCATION. (3)

An advanced seminar focusing on current critical research issues in mathematics education, the way research impacts education policies and practices, various methodological pursuits of researchers, and theory building.

SEM 706 RESEARCH IN STEM EDUCATION. (3)

Students will have the opportunity to learn about the research paradigms guiding STEM education research throughout history with critical analysis of those most utilized across the modern STEM education research communities. Students will acquire knowledge and skills that allow them to develop a research proposal with explicit discussion of their research assumptions and that targets meaningful and timely research questions in STEM education. Prereq: EDL 651, or EDP/EPE 557 and EPE 570, or EDP/EPE 660 or permission of instructor.

SEM 708 ENGINEERING IN STEM EDUCATION. (3)

SEM 708 will introduce students to the field of engineering and give them the opportunity to explore engineering concepts, engineering design, different fields of engineering, engineering curricular materials for K-12 students, research on including engineering in K-12 education, and assessments necessary in designing and developing research-based, interdisciplinary, engineering-design curricula for K-12 students and teachers. In SEM 708 students will experience, evaluate, and design interdisciplinary, engineering design-based curricula to be used within STEM classrooms. Prereq: EDC 707 or permission of instructor.

SEM 746 SUBJECT AREA INSTRUCTION IN THE SECONDARY SCHOOL. (0-9)

Students will teach in their subject areas in the schools full-time, meet regularly to discuss teaching effectiveness and strategies for improvement and develop their professional portfolios. May be repeated to a maximum of nine credits. Lecture, 3-9 hours; laboratory, 6-18 hours per week. Prereq: The appropriate methods course in the subject area (SEM 631, EDC 632, EDC 633, SEM 634 or EDC 635). Admission to the M.A./M.S. in Education (Initial Certification Option-Secondary Education). (Same as EDC 746.)

SEM 748 MASTER'S THESIS RESEARCH. (0)

Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.

SEM 767 DISSERTATION RESIDENCY CREDIT. (2)

Residency credit for dissertation research after the qualifying examination. Students may register for this course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended.

SEM Science, Technology, Engineering, and Mathematics

SEM 770 SPECIAL TOPICS IN STEM EDUCATION (Subtitle required). (1-4)

This course is a seminar of topical offerings with variable topics in the study of philosophy, principles, trends and research associate with STEM Education. This seminar is designed to cover topical issues around current research and strategies in STEM Education as they relate to P-20 implementation. STEM Education is transdisciplinary and constantly changing. This course will address content specific and transdisciplinary issues within the context of new directives and initiatives. May be repeated to a maximum of twelve credits. Prereq: SEM 603 and/or SEM 706 or permission of instructor.

SEM 781 INDEPENDENT STUDY IN STEM EDUCATION. (1-3)

An independent study course for graduate students. May be repeated to a maximum of nine credits. Prereq: Consent of the Director of Graduate Studies and Program Advisor.