

- 890 Independent Study**
Fall, Spring. 1 to 6 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department.
Special projects, directed reading, and research arranged by an individual graduate student and a faculty member in areas supplementing regular course offerings.
- 891 Special Topics in Russian Studies**
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department.
Special topics supplementing regular course offerings proposed by faculty on a group study basis for graduate students.
- 898 Master's Research**
Fall, Spring. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.
Directed research for Plan B master's degree requirements.
- 899 Master's Thesis Research**
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department.
Directed research for Plan A master's degree requirements.
- 990 Doctoral Independent Study**
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 18 credits in all enrollments for this course. R: Approval of department.
Special projects, directed reading, and research arranged by an individual doctoral student and a faculty member in areas supplementing the regular course offerings.
- 999 Doctoral Dissertation Research**
Fall, Spring, Summer. 1 to 99 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Approval of department.
Doctoral dissertation research.
- 301 Science for Elementary Schools**
Fall, Spring. 3(2-2) RB: Completion of an ISB and ISB laboratory or ISP and ISP laboratory course. Completion of the majority of complementary studies coursework in science and math. R: Open only to students in the Elementary Teacher Education Program. SA: NSC 301
Topics in earth science, life science, and physical science explored through discussion, demonstrations, readings, presentations, and field trips.
- 320 Integrated Science for Elementary Schools**
Spring. 3(2-2) Interdepartmental with Teacher Education. P:M: (SME 120) and (BS 110 or LBS 144 or LBS 148 H or BS 111 or LBS 145 or LBS 149 H or PSL 250 or ZOL 355) and (PHY 231 or PHY 231B or CEM 141 or LBS 171) and (GLG 201 or GEO 203 or AST 207) R: Open only to students in the Integrated Science teaching major. Not open to students with credit in SME 301.
Analysis of the concepts integrating science across life sciences, earth sciences, and physical sciences. Applications to the K-8 science curriculum.
- 340 Science Laboratories for Secondary Schools (W)**
Fall. 4(2-6) P:M: Completion of Tier I writing requirement. R: Open only to seniors in the BA degree in Chemistry, or the BS degree in Biological Science-Interdepartmental or Earth Science-Interdepartmental or General Science-Interdepartmental or Physical Science-Interdepartmental major or their associated LBS majors. SA: NSC 401
Laboratory equipment, supplies, demonstrations, exercises, and safety. Care of live organisms. Disposal of biological and chemical wastes. Field trips required.
- 420 Integrated Science Research for Elementary Schools**
Fall. 3(2-2) Interdepartmental with Teacher Education. P:M: (SME 320) and (STT 200 or STT 201) R: Open only to students in the Integrated Science teaching major.
Research design and data analysis of individual research projects relevant to the K-8 science curriculum, integrating topics in life, earth, and physical science.
- 490 Special Problems**
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of college.
Faculty directed individualized study of an interdisciplinary problem.
- 600 Special Problems for K-8 Teachers**
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 10 credits in all enrollments for this course. RB: Elementary teacher certification, 3 years teaching experience. R: Approval of college. SA: NSC 600
Supervised study of problems in biological, physical, or earth sciences.
- 630 Bridges to Science**
Summer. 1 credit. A student may earn a maximum of 3 credits in all enrollments for this course. RB: (NSC 301) SA: NSC 630
Scientific principles and concepts in integrative life, earth, and physical science.
- 651 Physical Science I**
Summer. 2 credits. RB: Elementary teacher certification, 3 years teaching experience. R: Approval of college. SA: NSC 651
The nature of matter and energy including energy transfer, density, and conservation of mass. Properties of elements, mixtures, and compounds.
- 652 Physical Science II**
Summer. 2 credits. RB: Elementary teacher certification, 3 years teaching experience. R: Approval of college. SA: NSC 652
Electricity and magnetism, force and motion, heat and temperature, sound, and light.
- 653 Earth Science I**
Summer. 2 credits. RB: Elementary teacher certification, 3 years teaching experience. R: Approval of college. SA: NSC 653
The solar system, including the sun, planets, earth, and its moon. Weather and the water cycle.
- 654 Earth Science II**
Summer. 2 credits. RB: Elementary teacher certification, 3 years teaching experience. R: Approval of college. SA: NSC 654
Rocks, minerals, and fossils and the physical and geological processes that form them.
- 655 Life Science I**
Summer. 2 credits. RB: Elementary teacher certification, 3 years teaching experience. R: Approval of college. SA: NSC 655
Structure, function, genetics, and classification of organisms, including protists, plants, animals, and decomposers.
- 656 Life Science II**
Summer. 2 credits. RB: Elementary teacher certification, 3 years teaching experience. R: Approval of college. SA: NSC 656
Interrelationships among and between organisms and their surroundings. Ecosystems, habitats, food chains, cycles, and pollution.
- 800 Problems in Biological or Physical Science for Teachers**
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 8 credits in all enrollments for this course. RB: Teacher Certification required. R: Approval of college. SA: NSC 800
Supervised study of problems in biological or physical science.
- 850 Cell and Molecular Biology**
Summer. 2 credits. RB: Secondary certification in biology, 3 years teaching experience. R: Approval of college. SA: NSC 850
Molecular basis of structure and function of cells. Protein structure and function, cell physiology, metabolic energy and transmission of genetic information.
- 851 Cell and Molecular Biology Laboratory**
Summer. 3 credits. RB: Secondary certification in biology; 3 years teaching experience. R: Approval of college. SA: NSC 851
Generation of laboratory exercises appropriate for secondary students.
- 852 Interdisciplinary Seminar in Biological Science**
Fall, Spring, Summer. 1 credit. RB: Secondary certification in biology; 3 years teaching experience. R: Approval of college. SA: NSC 852
Interrelationships of biological science and technology. Role of society in regulation of research and technological innovations.

SCIENCE AND MATHEMATICS EDUCATION

SME

College of Natural Science

- 120 Seminar in Integrated Science for Elementary Schools**
Spring. 1(1-1) Interdepartmental with Teacher Education. P:M: (BS 110 or BS 111 or CEM 141 or PHY 231 or PSL 250 or GLG 201 or GEO 203) R: Open only to students in the Integrated Science Teaching major, the Special Education major, the Child Development major, the Elementary Teacher Education program, the 5th-year teacher certification program, or approval of college.
Exploration of major connecting themes in life sciences, earth science, and physical science as evidenced in the K-8 science curriculum and college science courses.

Science and Mathematics Education—SME

855 Environmental and Behavioral Biology
Summer. 3 credits. Spring: Given only at Summer: Given only at W.K. Kellogg Biological Station. RB: Secondary certification in biology; 3 years teaching experience. R: Approval of college. SA: NSC 855

Biotic and abiotic features of lakes, streams, forest ecosystems, and microbial ecosystems.

856 Environmental and Behavioral Biology Laboratory
Summer. 3 credits. Summer: Given only at W.K. Kellogg Biological Station. RB: Secondary certification in biology, 3 years teaching experience. R: Approval of college. SA: NSC 856

Laboratory and field examinations of lake, stream and forest ecosystems.

860 Problem Solving Techniques in Physical Science
Summer. 3 credits. RB: (NSC 861 and NSC 862 and NSC 863) Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. R: Approval of college. SA: NSC 860

Measurement and analysis of chemical, physical, and geological phenomena.

861 Chemistry for Teachers
Summer. 2 credits. RB: Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. R: Approval of college. SA: NSC 861

Intensive lecture and laboratory study of basic chemistry from a modern viewpoint.

862 Physics for Teachers
Summer. 2 credits. RB: Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. R: Approval of college. SA: NSC 862

Intensive lecture and laboratory study of basic physics from a modern viewpoint.

863 Earth Science for Teachers
Summer. 2 credits. RB: Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. R: Approval of college. SA: NSC 863

Intensive lecture and laboratory study of basic earth sciences from a modern viewpoint.

864 Interdisciplinary Seminar in Physical Science
Summer. 2 credits. RB: (NSC 860) R: Approval of college. SA: NSC 864

Interrelationships of the physical sciences. The role of society in regulation of science to technology transfer.

870 Teaching College Science
Spring. 2 credits. RB: One year of graduate study in a biological or physical science. R: Approval of college. SA: NSC 870

Philosophies of education. Ethnic, gender, and cultural issues. Designing a laboratory course. Problems of class size. Instructional technologies. Assessment and evaluation.

889 Research for Inservice Teachers
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 10 credits in all enrollments for this course. RB: Open only to inservice K-12 teachers with baccalaureate degrees. R: Approval of college. SA: NSC 889

Research in faculty laboratories. Oral and written presentations.

899 Master's Thesis Research
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to master's students in the College of Natural Science. Approval of college. SA: NSC 899

Master's thesis research.

901 Frontiers in Biological Science
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 36 credits in all enrollments for this course. RB: Secondary certification in chemistry or physics or earth science or physical science or biology, 3 years teaching experience. R: Approval of college. SA: NSC 901

Weekend workshops with research faculty exploring background and latest findings in their area of research.

902 Frontiers in Physical Science
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 40 credits in all enrollments for this course. RB: Open only to students with secondary teacher certification in chemistry or physics or earth science or physical science or biology and 3 years of teaching experience. R: Approval of college. SA: NSC 902

Weekend workshops with research faculty exploring background and latest findings in their area of research.

612 Problems in Diagnostic Imaging Clerkship
Fall, Spring, Summer. 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. RB: (SCS 611) Completion of semester 5 of the graduate-professional program in the College of Veterinary Medicine. Advanced diagnostic radiography, ultrasound imaging, and magnetic resonance imaging.

613 Diagnostic Ultrasound Clerkship
Fall, Spring. 3 credits. RB: (SCS 611) Completion of semester 5 of the professional veterinary program. R: Open only to fourth year graduate-professional students in the College of Veterinary Medicine. Principles of ultrasound physics, ultrasound scanning techniques, and interpretation of ultrasound imaging.

625 Small Animal General Medicine Clerkship
Fall, Spring, Summer. 3 credits. RB: Completion of semester 5 of the professional veterinary program. R: Open only to graduate-professional students in College of Veterinary Medicine. Diagnostic and treatment services for routine and emergency outpatients.

626 Small Animal Soft Tissue Surgery Clerkship
Fall, Spring, Summer. 3 credits. RB: Completion of semester 5 of the professional veterinary program. R: Open only to graduate-professional students in College of Veterinary Medicine. Diagnosis and preoperative, surgical, and postoperative care of patients requiring routine elective and major soft-tissue surgical procedures.

630 Spay/Neuter Clerkship
Fall, Spring, Summer. 3 credits. RB: (SCS 626 and SCS 648) Completion of semester 5 of the graduate professional veterinary program. Ovariohysterectomy or orchiectomy. Aspects of pre- and post-operative management and anesthesia.

636 Problems in Soft Tissue Surgery Clerkship
Fall, Spring, Summer. 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. RB: (SCS 626) R: Completion of semester 5 of the graduate-professional program in the College of Veterinary Medicine. Soft tissue surgery problems.

637 Operative Surgery Clerkship: Instruction and Review
Fall. 3 credits. RB: Completion of semester 5 of the professional veterinary program. R: Open only to graduate-professional students in the College of Veterinary Medicine. Approval of department. Participation in the instruction of VM 557 (Operative Surgery), with preparation for the laboratory and discussion after the laboratory. Performance of additional surgical procedures, case discussions, rounds, and anatomy review. Approved independent study project required.

SMALL ANIMAL CLINICAL SCIENCES SCS

Department of Small Animal Clinical Sciences College of Veterinary Medicine

511 Veterinary Radiology
Fall. 1(1-0) R: Open only to graduate-professional students in College of Veterinary Medicine. Principles of veterinary radiology, radiation safety, and normal radiologic anatomy.

611 Diagnostic Imaging Clerkship
Fall, Spring, Summer. 3 credits. RB: Completion of semester 5 of the professional veterinary program. Diagnostic radiography and ultrasound imaging. Radiation safety. Special procedures.