958B. **Seminar in Orchestral Conducting**
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Open only to doctoral students in School of Music. Approval of school; audition required. Advanced conducting techniques for the orchestral literature of all periods for string, chamber, and symphony orchestras.

958C. **Seminar in Choral Conducting**
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Open only to doctoral students in School of Music. Approval of School of Music. Advanced conducting techniques for choral and instrumental music of all periods.

960. **Seminar in Measurement in Music Education**
Spring of odd-numbered years. 2(2-0)
P: MUS 864, MUS 865 or approval of school. R: Open only to graduate students in Music Education or approval of school.
Theory and practice in measuring the outcomes of music instruction in the cognitive, affective and psychomotor domains.

961. **Seminar in Music Teacher Education**
Fall of odd-numbered years. 2(2-0)
R: Open only to graduate students in College of Arts and Letters and in College of Education.
Issues, techniques, and problems in the preparation of school music educators.

962. **Seminar in Aesthetics in Music Education**
Fall of even-numbered years. 2(2-0)
R: Open only to graduate students in College of Arts and Letters and in College of Education.
Historical foundations of aesthetics. Concept of aesthetic education and implementation in the music classroom.

963. **Seminar in Administration of Music Programs**
Spring of even-numbered years. 2(2-0)
R: Open only to graduate students in College of Arts and Letters and in College of Education.
Techniques and problems in administering music programs in schools, colleges, and universities.

964. **Seminar in Music Education Trends**
Fall of odd-numbered years. 2(2-0)
R: Open only to graduate students in College of Arts and Letters and in College of Education.

965. **Advanced Research Methods in Music Education**
Fall. 3(0)
P: MUS 864. R: Open only to graduate students in College of Arts and Letters and in College of Education.
Music education research projects using computerized statistical analysis.

970. **Pedagogy of Theory I**
Fall of odd-numbered years. 2(2-0)
R: Open only to graduate students in School of Music. Organization, goals, and procedures for teaching music theory to undergraduates. Choice and sequencing of topics, pacing, supplementary materials, educational philosophies, and relevance to performance.

971. **Pedagogy of Theory II**
Spring of even-numbered years. 2(2-0)
R: Open only to graduate students in School of Music. Organization, goals, and procedures for teaching music theory to undergraduates. Ear training and sight singing, and their application to general musicianship.

972. **Analytical Studies I**
Fall. 3(0-0)
R: Open only to graduate students in School of Music. Melody, harmony, rhythm, color, texture, counterpoint, and structure in selected musical masterpieces from the 18th century to the early 19th century.

973. **Analytical Studies II**
Spring. 3(0-0)
R: Open only to graduate students in School of Music. Melody, harmony, rhythm, color, texture, counterpoint, and structure in selected musical masterpieces from the nineteenth and twentieth centuries.

974. **Atonality, Serialism, and Set Theory**
Spring. 2(2-0)
R: Open only to graduate students in School of Music. Atonal and prismatic music. Related compositional and analytical systems. Serialism, integral serialism, and set theory.

976. **Readings in Music Theory**
Spring of odd-numbered years. 2(2-0)
R: Open only to graduate students in School of Music. Current topics in music theory. Research paper required.

980. **Composition**
Fall, Spring. 2(2-0) A student may earn a maximum of 24 credits in all enrollments for this course.
R: Open only to graduate students in School of Music. Advanced guided projects in creative writing of music.

990. **Doctoral Independent Study**
Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 20 credits in all enrollments for this course.
R: Open only to graduate students in School of Music. Directed experience in concert conducting in partial fulfillment of requirements for the Doctor of Musical Arts degree.

997. **Doctoral Concert Conducting**
Fall, Spring, Summer. 1 to 2 credits. A student may earn a maximum of 30 credits in all enrollments for this course.
R: Open only to doctoral students in Music Performance. Directed experience in concert conducting in partial fulfillment of requirements for the Doctor of Musical Arts degree.

999. **Doctoral Dissertation Research**
Fall, Spring, and Social Science. 1 to 40 credits. A student may earn a maximum of 40 credits in all enrollments for this course.
R: Open only to doctoral students in School of Music. Approval of school.

**NATURAL SCIENCE**

**Natural Science — Descriptions of Courses**

101. **Preview of Science**
Fall. 1(1-0) Interdepartmental with Agriculture and Natural Resources, Engineering, and Social Science.
R: Approval of College.

192. **Environmental Issues Seminar**
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Agriculture and Natural Resources. College of Engineering, College of Natural Science, and College of Social Science. Approval of College.
Environmental issues and problems explored from a variety of perspectives, including legal, scientific, historical, political, socio-economic, and technical points of view.

201. **Science Problem Solving Seminar I**
Fall, Spring. 2(2-0) A: Drew Laboratory. B: MTH 225 or MTH 116 or MTH 152 concurrently. R: Approval of college.
Problem solving principles and strategies used in the disciplines of science and mathematics. Activities reflecting the types of problems encountered.

202. **Science Problem Solving Seminar II**
Spring. 2(2-0) P: NSC 201. R: Approval of college. Continuation of NSC 201.

203. **Drew Laboratory Directed Studies**
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
R: NSC 202. R: Open only to Drew Laboratory students. Using topics related to a faculty member's ongoing research, students explore the relationship between science and technology and social issues.

320. **Introduction to Theory and Applications of Modern Microscopy**
Spring, 2(1-2) P: Completion of University mathematics requirement. R: Open only to juniors and seniors. General principles of operation of electron, laser, and scanning probe microscopes. Applications of microscopy. Specimen preparation for microscopy.

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Descriptions — Natural Science of Courses

390. Special Problems
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Approval of department.
Faculty directed individualized study of an interdisciplinary problem.

401. Science Laboratories for Secondary Schools (W)
Fall. 493-6
R: Open only to seniors in the College of Natural Science with a teacher certification option. Completion of Tier 1 writing requirement.
Laboratory equipment, supplies, demonstrations, exercises, and safety. Care of live organisms. Disposal of biological and chemical wastes. Field trips required.

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 department.
Faculty directed individualized study of an interdisciplinary problem.

491. Selected Topics
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Approval of department.
Selected interdisciplinary topics not normally covered in other courses.

499. Research
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Open only to juniors and seniors in the College of Natural Science with a teacher certification option. Research in faculty laboratories. Oral and written presentations.

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.
R: Elementary teacher certification, 3 years teaching experience. Approval of college.
Supervised study of problems in biological, physical, or earth sciences.

651. Physical Science I
Summer. 2 credits.
R: Elementary teacher certification, 3 years teaching experience. Approval of college.
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.
R: Elementary teacher certification, 3 years teaching experience. Approval of college.
Electricity and magnetism, force and motion, heat and temperature, sound, and light.

653. Earth Science I
Summer. 2 credits.
R: Elementary teacher certification, 3 years teaching experience. Approval of college.
The solar system, including the sun, planets, earth, and its moon. Weather and the water cycle.

654. Earth Science II
Summer. 2 credits.
R: Elementary teacher certification, 3 years teaching experience. Approval of college.
Rocks, minerals, and fossils and the physical and geological processes that form them.

655. Life Science I
Summer. 2 credits.
R: Elementary teacher certification, 3 years teaching experience. Approval of college.
Structure, function, genetics, and classification of organisms, including prokaryotes, plants, animals, and decomposers.

656. Life Science II
Summer. 2 credits.
R: Elementary teacher certification, 3 years teaching experience. Approval of college.
Interruptions 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. 2 to 8 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
R: Teacher Certification required. Approval of college.
Supervised study of problems in biological or physical science.

802. Essentials of Electron Microscopy
Fall, Spring. 224-4
Principles of operation and uses of transmission and scanning electron microscopy. Related electron beam instruments. Specimen preparation and analytical methods.

810. Transmission Electron Microscopy Laboratory
Fall, Spring, Summer. 3(1-4)
P: NSC 802.
Use of transmission microscope and preparative equipment. Preparation techniques for specimens, photographic and darkroom use, and interpretation of micrographs.

Fall, Spring. 3(1-4)
P: NSC 802 or concurrently.

825. Special Problems in Electron Microscopy
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 40 credits in all enrollments for this course.
P: NSC 802, NSC 810 or NSC 820.
Use of electron microscopy techniques for selected research topics.

830. Ethical Issues in Biomedical Research
Fall. 1(1-4)
R: Open only to graduate students in the colleges of Agriculture and Natural Resources, Human Medicine, Natural Science, Osteopathic Medicine, or Veterinary Medicine.
Ethical issues and dilemmas related to the conduct of biomedical research.

850. Cell and Molecular Biology
Summer. 2 credits.
P: Secondary certification in biology, 3 years teaching experience. C: NSC 851. R: Secondary certification in biology, 3 years teaching experience; approval of college.
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.
Generation of laboratory exercises appropriate for secondary students.

852. Interdisciplinary Seminar in Biological Science
Fall, Spring, Summer. 1 credit.
P: Secondary certification in biology, 3 years teaching experience. R: Approval of college.
Interrelationships of biological science and technology. Role of society in regulation of research and technological innovations.

855. Environmental and Behavioral Biology
Summer. 3 credits. Given only at W.K. Kellogg Biological Station.
Biotic and abiotic features of lakes, streams, forest ecosystems, and microbial ecosystems.

860. Problem Solving Techniques in Physical Science
Fall, Spring. 2 credits.
P: NSC 861, NSC 862, NSC 863. R: Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. Approval of college.
Measurement and analysis of chemical, physical, and geological phenomena.

861. Chemistry for Teachers
Summer. 2 credits.
P: Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. R: Approval of college.
Intensive lecture and laboratory study of basic chemistry from a modern viewpoint.

862. Physics for Teachers
Summer. 2 credits.
P: Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. R: Approval of college.
Intensive lecture and laboratory study of basic physics from a modern viewpoint.

863. Earth Science for Teachers
Summer. 2 credits.
P: Secondary certification in chemistry or physics or earth science or physical science, 3 years teaching experience. R: Approval of college.
Intensive lecture and laboratory study of basic earth sciences from a modern viewpoint.

864. Interdisciplinary Seminar in Physical Science
Summer. 2 credits.
P: NSC 860. R: Approval of college.
Interrelationships of the physical sciences. The role of society in regulation of science to technology transfer.

870. Teaching College Science
Spring. 2 credits.
R: One year of graduate study in a biological or physical science. Approval of college.
Pedagogical and curricular issues. Designing a laboratory course. Problems of class size, instructional technologies. Assessment and evaluation.