



# Science Education

While the term "science" is applied generally to the study of natural phenomena, in the Science degree program at Bemidji State University it applies to a combined study of the life, earth, and physical sciences in the context of teacher certification for grades 5-8. This "broad science" degree is favored by school districts for their junior high/middle school science positions. Students in the Teacher Licensure Grades 5-12 degree program are also required to select at least one specialty for grades 9-12 from one of the following science areas: Chemistry, Earth and Space Science, Life Science, or Physics.

## Programs

- Elementary Education, B.S. (Science Endorsement (Teacher Licensure)) *major*
- Science Education, B.S. (Physics Specialty (Teacher Licensure)) *major*
- Science Education, B.S. (Chemistry Specialty (Teacher Licensure)) *major*
- Science Education, B.S. (Earth and Space Science Specialty (Teacher Licensure)) *major*
- Science Education, B.S. (Life Science Specialty (Teacher Licensure)) *major*

## Career Directions

- Middle School Teacher
- Junior High School Teacher
- High School Science Teacher

## Preparation

### Recommended High School Courses

- Biology
- Chemistry
- Physics
- Algebra
- Trigonometry

## Elementary Education, B.S. *major* Science Endorsement (Teacher Licensure)

Required Credits: 101  
Required GPA: 2.50

### I ELEMENTARY EDUCATION FOUNDATION COURSES

Complete the following courses:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4799 The Professional Teacher (1 credit)
- HLTH 3400 Health and Drugs in Society (2 credits)

Complete the following course, up to 12 credits:

- ED 4820 Student Teaching - Elementary (1-12 credits)

### II ELEMENTARY EDUCATION MAJOR COURSES

Complete the following courses:

- ED 3201 Language Arts I (3 credits)
- ED 3202 Language Arts II (3 credits)
- ED 3203 Language Arts III (3 credits)
- ED 3221 Elementary Math Methods (3 credits)
- ED 3222 Elementary Science Methods (3 credits)
- ED 3240 Social Studies in the Elementary School (3 credits)
- ED 3301 Creative Expressions (3 credits)
- ED 3302 Creative Process Foundations: Patterns (3 credits)
- HLTH 4100 Teaching Elementary School Health (2 credits)

- PHED 4200 Methods of Teaching Elementary Physical Education to Classroom Teachers (1 credit)

Complete the following course:

- MATH 1011 Mathematics for Elementary School Teachers I (3 credits)

Complete the following course:

- MATH 1013 Mathematics for Elementary School Teachers II (3 credits)

### SCIENCE ENDORSEMENT

COMPLETE THE FOLLOWING COURSES:

- BIOL 1400 Cellular Principles (4 credits)  
*or* BIOL 1110 Human Biology (4 credits)
- BIOL 1500 Diversity of Life (4 credits)  
*or* BIOL 1120 General Biology: Evolution And Ecology (3 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)  
*or* CHEM 1111 General Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)  
*or* CHEM 1112 General Chemistry II (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)  
*or* ED 3410 Secondary Science Methods (4 credits)

### EDUCATION CORE

COMPLETE THE FOLLOWING COURSES:

- ED 3417 Teaching and Learning in the Middle School (3 credits)
- ED 4737 Content Area Reading (3 credits)

COMPLETE THE FOLLOWING COURSE (5 CREDITS):

- ED 4840 Student Teaching - Special Fields (1-12 credits)

## Science Education, B.S. *major* Physics Specialty (Teacher Licensure)

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Required Credits: 83  
Required GPA: 2.50

### Core Courses for Science Teaching in Grades 5-8

#### COMPLETE THE FOLLOWING COURSES:

- BIOL 1400 Cellular Principles (4 credits)  
*or* BIOL 1110 Human Biology (4 credits)
- BIOL 1500 Diversity of Life (4 credits)  
*or* BIOL 1120 General Biology: Evolution And Ecology (3 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)  
*or* CHEM 1111 General Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)  
*or* CHEM 1112 General Chemistry II (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)  
*or* ED 3410 Secondary Science Methods (4 credits)

#### REQUIRED PROFESSIONAL EDUCATION COURSES

Complete the following courses with a minimum 2.50 GPA:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4737 Content Area Reading (3 credits)
- ED 4799 The Professional Teacher (1 credit)

Complete the following course:

- HLTH 3400 Health and Drugs in Society (2 credits)

Complete 12 credits of student teaching:

- ED 4830 Student Teaching - Secondary (1-12 credits)

#### PHYSICS SPECIALTY

#### COMPLETE THE FOLLOWING COURSES:

MATH 2471 Calculus I (5 credits) is recommended (required for PHYS 2101 Physics I (4 credits))

- PHYS 2101 Physics I (4 credits)  
*or* PHYS 1101 General Physics I (4 credits)
- PHYS 2102 Physics II (4 credits)  
*or* PHYS 1102 General Physics II (4 credits)
- PHYS 2500 Electronics (4 credits)
- PHYS 3103 Physics III (4 credits)
- PHYS 4300 Optics (4 credits)

#### COMPLETE THE FOLLOWING COURSE:

- PHYS 4980 Research (3 credits)

## Science Education, B.S. *major* Chemistry Specialty (Teacher Licensure)

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Required Credits: 78  
Required GPA: 2.50

### Core Courses for Science Teaching in Grades 5-8

#### COMPLETE THE FOLLOWING COURSES:

- BIOL 1400 Cellular Principles (4 credits)  
*or* BIOL 1110 Human Biology (4 credits)
- BIOL 1500 Diversity of Life (4 credits)  
*or* BIOL 1120 General Biology: Evolution And Ecology (3 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)  
*or* CHEM 1111 General Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)  
*or* CHEM 1112 General Chemistry II (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)  
*or* ED 3410 Secondary Science Methods (4 credits)

#### REQUIRED PROFESSIONAL EDUCATION COURSES

Complete the following courses with a minimum 2.50 GPA:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4737 Content Area Reading (3 credits)
- ED 4799 The Professional Teacher (1 credit)

Complete the following course:

- HLTH 3400 Health and Drugs in Society (2 credits)

Complete 12 credits of student teaching:

- ED 4830 Student Teaching - Secondary (1-12 credits)

#### CHEMISTRY SPECIALTY

#### COMPLETE THE FOLLOWING COURSES:

- CHEM 3110 Laboratory Management and Safety (2 credits)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 3980 Research (1 credit)

#### SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4811 Advanced Inorganic Chemistry I (3 credits)

## Science Education, B.S. *major*

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## Earth and Space Science Specialty (Teacher Licensure)

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Required Credits: 86  
Required GPA: 2.50

### Core Courses for Science Teaching in Grades 5-8

#### COMPLETE THE FOLLOWING COURSES:

- BIOL 1400 Cellular Principles (4 credits)  
or BIOL 1110 Human Biology (4 credits)
- BIOL 1500 Diversity of Life (4 credits)  
or BIOL 1120 General Biology: Evolution And Ecology (3 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)  
or CHEM 1111 General Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)  
or CHEM 1112 General Chemistry II (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)  
or ED 3410 Secondary Science Methods (4 credits)

#### REQUIRED PROFESSIONAL EDUCATION COURSES

Complete the following courses with a minimum 2.50 GPA:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4737 Content Area Reading (3 credits)
- ED 4799 The Professional Teacher (1 credit)

Complete the following course:

- HLTH 3400 Health and Drugs in Society (2 credits)

Complete 12 credits of student teaching:

- ED 4830 Student Teaching - Secondary (1-12 credits)

#### EARTH AND SPACE SCIENCE SPECIALTY

##### COMPLETE THE FOLLOWING COURSES:

- ENVR 2000 Introduction to Environmental Science (3 credits)
- GEOL 1120 Historical Geology (4 credits)
- GEOL 2110 Mineralogy and Petrology (4 credits)
- GEOL 3500 Topics in Paleontology (3 credits)
- GEOL 3600 Stratigraphy and Sedimentation (3 credits)
- SCI 2100 Astronomy (3 credits)

SELECT 1 OF THE FOLLOWING COURSES:

- GEOL 3211 Environmental Hydrology (3 credits)
- ENVR 4050 Geochemistry (3 credits)

SELECT 1 OF THE FOLLOWING COURSES:

- GEOL 4970 Internship (3 credits)
- GEOL 4980 Research (3 credits)

## Science Education, B.S. *major* Life Science Specialty (Teacher Licensure)

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Required Credits: 83  
Required GPA: 2.50

### Core Courses for Science Teaching in Grades 5-8

#### COMPLETE THE FOLLOWING COURSES:

- BIOL 1400 Cellular Principles (4 credits)  
or BIOL 1110 Human Biology (4 credits)
- BIOL 1500 Diversity of Life (4 credits)  
or BIOL 1120 General Biology: Evolution And Ecology (3 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)  
or CHEM 1111 General Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)  
or CHEM 1112 General Chemistry II (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)  
or ED 3410 Secondary Science Methods (4 credits)

#### REQUIRED PROFESSIONAL EDUCATION COURSES

Complete the following courses with a minimum 2.50 GPA:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4737 Content Area Reading (3 credits)
- ED 4799 The Professional Teacher (1 credit)

Complete the following course:

- HLTH 3400 Health and Drugs in Society (2 credits)

Complete 12 credits of student teaching:

- ED 4830 Student Teaching - Secondary (1-12 credits)

#### LIFE SCIENCE SPECIALTY

##### A. REQUIRED BIOLOGY COURSES

##### COMPLETE THE FOLLOWING COURSES:

- BIOL 2360 Genetics (4 credits)
- BIOL 2610 General Ecology (3 credits)
- BIOL 3710 Microbiology (4 credits)
- BIOL 4620 Evolution (3 credits)
- BIOL 3720 Plant Form and Function (4 credits)  
or BIOL 3830 Aquatic Plants and Algae (4 credits)
- BIOL 4894 Advanced Research Project I (2 credits)  
or BIOL 4895 Advanced Research Project II (2 credits)

##### B. REQUIRED BIOLOGY ELECTIVE

##### SELECT 1 OF THE FOLLOWING COURSES:

- BIOL 3150 Animal Behavior (3 credits)
- BIOL 3310 Entomology (3 credits)
- BIOL 4510 Ornithology (3 credits)

- BIOL 4520 Mammalogy (3 credits)
- BIOL 4534 Ichthyology (4 credits)

## SUGGESTED SEMESTER SCHEDULE FOR LIFE SCIENCE SPECIALTY, SCIENCE EDUCATION MAJOR, B.S. (TEACHER LICENSURE)

The following is a list of required Science (Life Science) Major, B.S. courses arranged by year. This schedule is intended to assist students in planning their courses. There is some flexibility in this schedule, but graduation within four years will require close adherence to the specified sequence of courses. Always consult your Biology academic advisor as to the proper courses and sequence of courses needed for graduation. It is possible, in some circumstances, that courses in a student's Liberal Education program may be used in his or her academic major.

### Freshman

- BIOL 1400 Cellular Principles (4 credits)
- BIOL 1500 Diversity of Life (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)
- Liberal Education requirements

### Sophomore

- BIOL 2360 Genetics (4 credits)
- BIOL 2610 General Ecology (3 credits)
- BIOL 4894 Advanced Research Project I (2 credits) or BIOL 4895
- BIOL 3720 Plant Form and Function (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- PHYS 1101 General Physics I (4 credits)  
or PHYS 2101 Physics I (4 credits)
- Consider starting Professional Education sequence
- Liberal Education requirements

### Junior

- BIOL 3710 Microbiology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)
- Other Professional Education requirements
- Liberal Education requirements

### Senior

- Biology Elective (BIOL 3150, 3310, 3510, 4520, or 4534)
- BIOL 4620 Evolution (3 credits)
- Complete Professional Education requirements, including one semester of student teaching
- Complete liberal education requirements

## Science Courses

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### SCI 1110 Physical Science I (4 credits)

A single-semester survey of Physical Science, with laboratory. Includes selected topics in physics, chemistry, geology, astronomy, and meteorology. Includes laboratory and computer sessions. Liberal Education Goal Area 3 (LC).

### SCI 1120 Physical Science II (4 credits)

Science and Technology in Society (STS). An alternative perspective on Physical Science, using selected topics to discuss societal concerns and responsibilities. Includes laboratory and related computer-based small group sessions. Liberal Education Goal Area 3 (LC).

### SCI 1910 Directed Independent Study (3 credits)

Arranged individual study.

### SCI 1920 Directed Group Study (3 credits)

Arranged group study.

### SCI 1930 Experimental Course (3 credits)

A course proposed for inclusion in the University curriculum. May not be offered more than two times as an experimental course.

### SCI 1940 In-Service Course (3 credits)

A course for practitioners seeking additional training or expertise in their current vocation or profession. The in-service format typically includes an educational experience in which a University faculty member and a group of students concentrate on working toward the resolution of a specific problem.

### SCI 1950 Workshop, Institute, Tour (3 credits)

An intense, credit-granting academic experience of short duration (usually from two days to two weeks) that is not listed in the current University curriculum. Provides for the practical application of theoretical learning within a group setting, and may include the development of methods and skills and the discussion of ideas and principles.

### SCI 1960 Special Purpose Instruction (3 credits)

A course intended for specific groups or organizations outside the University community.

### SCI 1970 Internship (3 credits)

Graded Satisfactory/Unsatisfactory only. Student internships may be either full-time or part-time in a public or private agency appropriate to the degree objective. Internships consist of closely supervised periods of service that are arranged in advance of the course registration. Students should consult their advisor concerning prerequisites.

### SCI 1980 Research (3 credits)

Research carried out by the student that is based on appropriate methodology and scholarship.

### SCI 1990 Thesis (3 credits)

A thesis written by the student that reports extensive original research carried out by the student and demonstrates appropriate methodology and scholarship.

### SCI 2100 Astronomy (3 credits)

A one-semester survey course, with emphasis on the history of astronomy, the science of stellar and solar system formation, the evolution of stars and galaxies, and modern cosmology and the fate of the universe. Includes laboratory simulations and field exercises. Liberal Education Goal Area 3.

### SCI 2200 Meteorology (3 credits)

A one-semester survey course, with emphasis on the science of the atmospheric dynamics of weather and climate, precipitation, storms, and forecasting. Includes laboratory simulations and field exercises. Liberal Education Goal Area 3.

### SCI 2651 Study-Travel Natural Science (1-6 credits)

Study Travel course in Science for Lab Ed Goal Area 3.

### SCI 2910 Directed Independent Study (3 credits)

Arranged individual study.

### SCI 2920 Directed Group Study (3 credits)

Arranged group study.

### SCI 2925 People of the Environment: Science Perspective (3 credits)

The discussions of this section will include the specific relation between air, water, and solid waste pollution and the effect on the environment, including the following: acid rain, smog, global warming, measurement of environmental pollutants, and the role of science in solving pollution problems. Liberal Education Goal Area 10.

### SCI 2930 Experimental Course (3 credits)

A course proposed for inclusion in the University curriculum. May not be offered more than two times as an experimental course.

**SCI 2940 In-Service Course (3 credits)**

A course for practitioners seeking additional training or expertise in their current vocation or profession. The in-service format typically includes an educational experience in which a University faculty member and a group of students concentrate on working toward the resolution of a specific problem.

**SCI 2950 Workshop, Institute, Tour (3 credits)**

An intense, credit-granting academic experience of short duration (usually from two days to two weeks) that is not listed in the current University curriculum. Provides for the practical application of theoretical learning within a group setting, and may include the development of methods and skills and the discussion of ideas and principles.

**SCI 2951 Study-Travel Natural Science (1-6 credits)**

Study Travel course in Science for Lib Ed Goal Area 3.

**SCI 2960 Special Purpose Instruction (3 credits)**

A course intended for specific groups or organizations outside the University community.

**SCI 2970 Internship (3 credits)**

Graded Satisfactory/Unsatisfactory only. Student internships may be either full-time or part-time in a public or private agency appropriate to the degree objective. Internships consist of closely supervised periods of service that are arranged in advance of the course registration. Students should consult their advisor concerning prerequisites.

**SCI 2980 Research (3 credits)**

Research carried out by the student that is based on appropriate methodology and scholarship.

**SCI 2990 Thesis (3 credits)**

A thesis written by the student that reports extensive original research carried out by the student and demonstrates appropriate methodology and scholarship.

**SCI 3100 Integrative Science for Teachers (4 credits)**

An interdisciplinary laboratory-based course incorporating the areas of biology, chemistry, earth science, and physics. Focuses on conducting a series of investigations by Science Inquiry and demonstrating the connection between the various disciplines. Prerequisites: 2 courses each in the life sciences and physical sciences.

**SCI 3450 Science Methods For Grades 5-8 (4 credits)**

Strategies for implementation of the Minnesota Graduation Standards in the areas of Science and Inquiry for grades 5-8. Strategies include laboratory activities, discussions, the development of classroom activities, and the adaptation of these strategies for use in the elementary and high school science classroom. Prerequisite: Senior status or consent of instructor.

**SCI 3910 Directed Independent Study (3 credits)**

Arranged individual study.

**SCI 3920 Directed Group Study (3 credits)**

Arranged group study.

**SCI 3930 Experimental Course (3 credits)**

A course proposed for inclusion in the University curriculum. May not be offered more than two times as an experimental course.

**SCI 3940 In-Service Course (3 credits)**

A course for practitioners seeking additional training or expertise in their current vocation or profession. The in-service format typically includes an educational experience in which a University faculty member and a group of students concentrate on working toward the resolution of a specific problem.

**SCI 3950 Workshop, Institute, Tour (3 credits)**

An intense, credit-granting academic experience of short duration (usually from two days to two weeks) that is not listed in the current University curriculum. Provides for the practical application of theoretical learning within a group setting, and may include the development of methods and skills and the discussion of ideas and principles.

**SCI 3960 Special Purpose Instruction (3 credits)**

A course intended for specific groups or organizations outside the University community.

**SCI 3970 Internship (3 credits)**

Graded Satisfactory/Unsatisfactory only. Student internships may be either full-time or part-time in a public or private agency appropriate to the degree objective. Internships consist of closely supervised periods of service that are arranged in advance of the course registration. Students should consult their advisor concerning prerequisites.

**SCI 3980 Research (3 credits)**

Research carried out by the student that is based on appropriate methodology and scholarship.

**SCI 3990 Thesis (3 credits)**

A thesis written by the student that reports extensive original research carried out by the student and demonstrates appropriate methodology and scholarship.

**SCI 4910 Directed Independent Study (3 credits)**

Arranged individual study.

**SCI 4917 DIS Tchg Assoc | (1-2 credits)**

Directed Independent Study | Teaching Associate

**SCI 4920 Directed Group Study (3 credits)**

Arranged group study.

**SCI 4930 Experimental Course (3 credits)**

A course proposed for inclusion in the University curriculum. May not be offered more than two times as an experimental course.

**SCI 4940 In-Service Course (3 credits)**

A course for practitioners seeking additional training or expertise in their current vocation or profession. The in-service format typically includes an educational experience in which a University faculty member and a group of students concentrate on working toward the resolution of a specific problem.

**SCI 4950 Workshop, Institute, Tour (3 credits)**

An intense, credit-granting academic experience of short duration (usually from two days to two weeks) that is not listed in the current University curriculum. Provides for the practical application of theoretical learning within a group setting, and may include the development of methods and skills and the discussion of ideas and principles.

**SCI 4960 Special Purpose Instruction (3 credits)**

A course intended for specific groups or organizations outside the University community.

**SCI 4970 Internship (3 credits)**

Graded Satisfactory/Unsatisfactory only. Student internships may be either full-time or part-time in a public or private agency appropriate to the degree objective. Internships consist of closely supervised periods of service that are arranged in advance of the course registration. Students should consult their advisor concerning prerequisites.

**SCI 4980 Research (3 credits)**

Research carried out by the student that is based on appropriate methodology and scholarship.

**SCI 4990 Thesis (3 credits)**

A thesis written by the student that reports extensive original research carried out by the student and demonstrates appropriate methodology and scholarship.

**All-University Courses**

The course numbers listed below, not always included in the semester class schedule, may be registered for by consent of the advisor, instructor, or department chair, or may be assigned by the department when warranted. Individual registration requires previous arrangement by the student and the completion of any required form or planning outline as well as any prerequisites.

1910, 2910, 3910, 4910 DIRECTED INDEPENDENT STUDY

1920, 2920, 3920, 4920 DIRECTED GROUP STUDY  
1930, 2930, 3930, 4930 EXPERIMENTAL COURSE  
1940, 2940, 3940, 4940 IN-SERVICE COURSE  
1950, 2950, 3950, 4950 WORKSHOP, INSTITUTE, TOUR  
1960, 2960, 3960, 4960 SPECIAL PURPOSE INSTRUCTION  
1970, 2970, 3970, 4970 INTERNSHIP  
1980, 2980, 3980, 4980 RESEARCH  
1990, 2990, 3990, 4990 THESIS