

ACADEMIC SENATE PROPOSAL TRACKING SHEET

(Document To Be Originated By Academic Senate Secretary On Canary Color Paper)

All proposals MUST have their originating college faculty body (Ex. Nursing, Technical Sciences, Arts & Sciences, Education) approval and must be signed by the submitter and the college chair/dean before being submitted to the academic senate secretary.

1. Submit all proposals (using the appropriate Academic Senate program/degree and/or course revision forms) to the Academic Senate Secretary.
2. The Academic Senate Secretary logs and numbers items and forwards them to the appropriate Academic Senate subcommittee(s): Teacher Education (if applicable), General Education (if applicable), or Curriculum.
3. The Academic Senate subcommittee(s) consider(s) the proposal. If approved, the proposal is forwarded to the next committee. If a committee disapproves the proposal, the originator may request that the item be forwarded to the next body for consideration. The committee will provide written rationale to the originator when a proposal is disapproved and the proposal is returned to the originator.
4. The Academic Senate considers the proposal and approves or disapproves. If approved, the proposal is forwarded to the Full Faculty for consideration. If the Academic Senate disapproves the proposal, the originator may request that the item be forwarded to the Full Faculty for consideration. The Academic Senate will provide written rationale to the originator when proposals are disapproved and the proposal is returned to the originator.
5. The Full Faculty considers academic senate approved proposals. If faculty approve, the proposal will then be forwarded to the Provost. The Provost approves or disapproves the proposal. If approved, the proposal is then forwarded to the Chancellor.
7. The Chancellor approves or disapproves the proposal.

Subcommittee and Academic Senate college representatives will notify their respective colleges' of the progress of submitted proposals or the proposal may be tracked via the web page --

<http://www.msun.edu/admin/provost/asproposals.htm>

Documentation and forms for the curriculum process is also available on the web page:

<http://www.msun.edu/admin/provost/asforms.htm>

***** (If a proposal is disapproved at any level, it is returned through the Academic Senate secretary to the Chair/Dean of the submitting college who then notifies the originator.)

Proposal # <u>02-19</u>	Title: <u>Clarification of lab science reqs - BIOL & CHEM</u>
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(proposal explanation, submitter and college chair/dean signatures on attached program/degree or course revision form)

Received by ACAD Senate Date 12/14/02
 Forwarded to Teacher Ed Council Approved _____ Disapproved _____

Forwarded to Gen Ed Committee 12/10/03 NA
Signature _____ Date _____
Approved _____ Disapproved _____

Returned to ACAD Senate 12/18/02 3/14/03
 Forwarded to Curriculum Committee 12/18/02 2/11/03
Signature _____ Date _____
Approved _____ Disapproved _____

Returned to ACAD Senate for Vote 1/21/03 3/4/03
Signature _____ Date _____
Approved _____ Disapproved _____

Sent to Provost's office for Full Faculty vote 3/12/03
 Voted on at Full Faculty meeting MAR 25 2003
Signature _____ Date _____
Approved _____ Disapproved _____

Forwarded to Provost for Approval/Disapproval MAR 26 2003
Signature _____ Date _____
Approved _____ Disapproved _____

SEE my additional course description changes on subsequent pages.

Forwarded to Chancellor for Approval/Disapproval APR 7 2003
Signature _____ Date _____
Approved _____ Disapproved _____

Copies sent to originating college and registrar's office APR 8 2003
 C:/data/proposaltracking sheet ACAD 10 10 01

TO: Larry Strizich
Will Rawn

FROM: Roger Barber

RE: Clarification of the Laboratory Science Requirements

DATE: April 7, 2003

I have approved all of the laboratory science course revisions forms that were recently approved by the full faculty. Those forms clarified which courses satisfied. . .or did not satisfy. . .the area C, laboratory science requirement in MSU-Northern's general education program.

I think some of the resulting course descriptions are extremely confusing, however, particularly from the perspective of a student. For example:

The course description for BIOL 279 says that it includes lecture and laboratory hours. But the new course description immediately says that the course does not meet the laboratory science requirement. That is contradictory, to say the least. And baffling from a student's perspective.

As a consequence, I DID MAKE some changes in the course descriptions to clarify the purpose of the course and to incorporate the recently-approved changes. I did that primarily in an effort to eliminate any confusion, wherever possible, for students, without changing the intent or consequences of the new language approved by the faculty. The results are a bit redundant, but that redundancy emphasizes the purpose of the new course description language.

For example, in the above-described cooperative education course description, I simply deleted the old language that says "includes lecture and laboratory hours." If the laboratory hours don't count for anything, why confuse students by including them in the description? Obviously, the new language will be added to the description. A couple of additional examples will illustrate what I have done:

TSCI 110, Introduction to Water and Wastewater. Introduction to drinking water and sewerage/wastewater treatment systems. Topics include plant layouts, process control. . . and laboratory procedures. The laboratory procedures are not the kinds of experiences that satisfy the laboratory science requirement. This course does not meet the laboratory science requirement.

TSCI 206, Applied Water Hydraulics. Applied hydraulics including study of water and wastewater collection and distribution, maintenance, and safety. Includes lecture and laboratory hours, but the laboratory hours are not the kind of experience that satisfies the laboratory science requirement. This course does not meet the laboratory science requirement.

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Proposal # 02-19	Title: Clarification of lab science reqs - BIOL & CHEM
(proposal explanation, submitter and college chair/dean signatures on attached program/degree or course revision form)	

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Returned to ACAD Senate 12/18/02 2/11/03 Date
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 Signature [Signature] Date _____
 Approved 3/4/03 Disapproved _____

Returned to ACAD Senate for Vote 1/21/03 3/4/03 Date
to be sent to Gen Ed
ACAD SENATE
 Signature [Signature] Date 3/11/03
 Approved _____ Disapproved _____

Sent to Provost's office for Full Faculty vote 3/12/03
 Voted on at Full Faculty meeting _____
 Signature _____ Date _____
 Approved _____ Disapproved _____

Forwarded to Provost for Approval/Disapproval _____
 Signature _____ Date _____
 Approved _____ Disapproved _____

Forwarded to Chancellor for Approval/Disapproval _____
 Signature _____ Date _____
 Approved _____ Disapproved _____

Copies sent to originating college and registrar's office _____
 C/data/proposaltracking sheet ACAD 10 10 01

BIOL 322 Botany II	This course does meet the laboratory science requirement.
BIOL 324 Entomology	This course does meet the laboratory science requirement.
BIOL 334 Ornithology	This course does meet the laboratory science requirement.
BIOL 350 Zoology Laboratory	This course taken in conjunction with the lecture portion of the course (BIOL 348) meets the laboratory science requirement.
BIOL 406 Molecular Biology Techniques	This course does meet the laboratory science requirement.
BIOL 407 Freshwater Biology	This course does meet the laboratory science requirement.
BIOL 408 Flowering Plants of the Plains and Mountains	This course does meet the laboratory science requirement.
BIOL 415 Ecological Methods	This course does meet the laboratory science requirement.
BIOL 425 Methods of Teaching Secondary Science	This course does meet the laboratory science requirement.
BIOL 460 Advanced Microbiology	This course does meet the laboratory science requirement.
BIOL 468 Molecular Biology and Genetics	This course does meet the laboratory science requirement.
BIOL 479 Cooperative Education	This course does not meet the laboratory science requirement.
BIOL 506 Molecular Biology Techniques	This course does meet the laboratory science requirement.
BIOL 507 Freshwater Biology	This course does meet the laboratory science requirement.
BIOL 508 Flowering Plants of the Plains and Mountains	This course does meet the laboratory science requirement.
BIOL 515 Ecological Methods	This course does meet the laboratory science requirement.
BIOL 568 Molecular Biology and Genetics	This course does meet the laboratory science requirement.
BIOL 635 Advanced Zoology	This course does meet the laboratory science requirement.

Required by: Biology

Current Catalog Description (include all prerequisites):
Same-see attached

Proposed or New Catalog Description (include all prerequisites):

See above

Course Outcome Objectives:

N/A

Additional instructional resources needed (including library materials, special equipment, and facilities). Please note: approval does not indicate support for new faculty or additional resources.

ACAD course revision form 10-10-2001 rev. 12-12-01

BIOL 110 Introduction to Environmental Health 3 semester credits An orientation to the field of environmental health and human interactions with the environment, including a survey of topics of environmental protection, food and water, waste water processes, solid waste disposal, living and working environments, epidemiology of environmentally associated diseases, and pollution control policy. Current federal and state regulations are reviewed.

BIOL 140 Cell Biology 4 semester credits The structure and function of plant and animal cells, including respiration, photosynthesis, reproduction, genetics, and protein synthesis. Other topics considered are tissues, embryology, and unicellular organisms. Concurrent enrollment in BIOL 141 Lab is required.

BIOL 141 Cell Biology Laboratory 1 semester credit Laboratory studies in cell structure and function, respiration, photosynthesis, reproduction, genetics, tissues, embryology, and unicellular organisms. Must be taken concurrently with BIOL 140. **Course Fee: \$12.00**

BIOL 151 Essentials of Biology 4 semester credits An introduction to biology, including chemical principles, cell structure and function, classification and characteristics of bacteria, protists, fungi, plants, and animals, and such ecological concepts as ecosystems, energy relationships, cycles, succession, and populations. Includes lecture and laboratory hours. **Course Fee: \$10.00**

BIOL 204 Essentials of Anatomy and Physiology 4 semester credits An introduction to the organ systems of the human body, including chemical principles, cell and tissue study, and the organ systems: muscular, skeletal, integumentary, digestive, circulatory, immune, respiratory, excretory, nervous, muscular, skeletal, endocrine, and reproductive. Includes lecture and laboratory hours. **Course Fee: \$8.00**

BIOL 217 Microbiology 4 semester credits A survey of the microbial world including bacteria, viruses, protozoa, algae and fungi, relationships of microorganisms to man and to the environment including health and disease, cultivation, isolation, microbial metabolism and genetics, with emphasis on antisepsis and medical microbiology for students entering health related fields as well as applied microbiology related to water quality. Appropriate for students in general education and science and health related programs. Includes lecture and laboratory hours. Recommended: high school biology or BIOL 140. **Course Fee: \$20.00**

BIOL 221 Botany I 3 semester credits Introduction to the plant kingdom that primarily focuses upon the cytology, anatomy, morphology, and general physiology of the flowering plants. Concurrent enrollment in BIOL 222 is required. Prerequisite: Basic college biology course.

BIOL 222 Botany I Laboratory 2 semester credits Laboratory activities that primarily focus upon the cytology, anatomy, morphology, taxonomy of the flowering plants. Concurrent enrollment in BIOL 221 is required. **Course Fee: \$5.00**

BIOL 241 Anatomy and Physiology I 4 semester credits An introduction to the form and function of the parts of the human body, with studies on the tissues, bones, muscles, respiration, and circulation. Includes lecture and laboratory hours. Prerequisite: High School Biology or BIOL 140 are strongly recommended. Placement exam will be administered. **Course Fee: \$13.00**

BIOL 242 Anatomy and Physiology II 4 semester credits Emphasis on the regulations of the energy supply and the internal environment. Units covered are nerves, endocrines, digestion, cell metabolism, excretion, and reproduction. Includes lecture and laboratory hours. Prerequisites: BIOL 241; or BIOL 140 and CHEM 111 or equivalent. **Course Fee: \$13.00**

BIOL 250 Undergraduate Research 3 semester credits Opportunity to perform undergraduate research under the counsel and guidance of departmental staff. Students will summarize research results in scientific papers and oral presentations. Prerequisite: consent of instructor.

BIOL 279 Cooperative Education 1, 3, 6 or 12 semester credits A planned and supervised work-learning experience in industry, business, government, or community service agencies related to the University program of study. Prerequisites: Two semesters of attendance at Montana State University-Northern, approval of advisor, Chair/Dean of the College of Arts and Sciences, and cooperative education coordinator. Includes lecture and laboratory hours

delete this sentence

BIOL 314 General Ecology 4 semester credits Integrated principles of ecology with special emphasis on terrestrial ecosystems. Some attention directed to selected ecological methods and statistical evaluations via laboratory activities. Offered alternate years. Prerequisites: BIOL 140 or BIOL 151 or BIOL 221.

BIOL 322 Botany II 4 semester credits A general survey of the plant kingdom and plant classification with special emphasis on bryophytes, and the non-flowering tracheophytes and their reproductive processes, together with an introduction to algae and the fungi. Offered alternate years. Prerequisite: Basic college biology course.

BIOL 324 Entomology 3 semester credits An introduction to the anatomy, characteristics and classification of insects including methods of collecting, preserving, identifying, and displaying insects. Preparation of an insect collection is required. Offered alternate years. Prerequisite: BIOL 348 or consent of instructor. **Course Fee: \$9.00**

BIOL 334 Ornithology 3 semester credits The biology of birds, including their morphology, physiology, behavior, ecology, and classification. Emphasis on the recognition of Montana species, developed through the use of photos, preserved skins, and local field trips. Offered alternate years. Prerequisite: BIOL 348 or consent of instructor. **Course Fee: \$5.00**

BIOL 348 Zoology 3 semester credits A survey of invertebrate and vertebrate animal phyla including classification, morphology, physiology, characteristics, and natural history. Concurrent enrollment in BIOL 350 required. Prerequisite: BIOL 140 or equivalent.

BIOL 350 Zoology Laboratory 2 semester credits The laboratory component of BIOL 348. Microscopic and macroscopic studies of animals. Dissection of squid, earthworms, crayfish, sea stars, dogfish sharks, frogs, fetal pigs, and others. Concurrent enrollment in BIOL 348 required. **Course Fee: \$13.00**

BIOL 406 Molecular Biology Techniques 3 semester credits Introduction to such techniques of molecular biology as electrophoresis and chromatography as these methodologies are employed in the fields of cytology, molecular genetics, and physiology. Graduate credit requirements are described in the course syllabus.

BIOL 407 Freshwater Biology 3 semester credits The focus of the course will be directed towards examination, identification, and classification of a wide variety of freshwater organisms abundant in Montana's aquatic systems. Extensive laboratory work and field trips are required. Graduate credit requirements are described in the syllabus. Prerequisites: basic biology course.

BIOL 408 Flowering Plants of the Plains and Mountains 3 semester credits Study of flowering plants found in prairie, foothill, mountain, riparian, and aquatic habitats. Methods of collection, general identification, and preservation of a series of plant specimens, including development of a herbarium, are included. Graduate credit requirements are described in the syllabus.

BIOL 415 Ecological Methods 3 semester credits Study of methodologies used by ecologists to examine the environment. Laboratory and field procedures are stressed, together with review of associated ecological concepts. Graduate credit requirements are described in the syllabus. Prerequisite: Basic ecology course.

BIOL 425 Methods of Teaching Secondary Science 2 semester credits Practical and hands-on approach to illustrating the techniques and materials for teaching at the secondary level in the physical and biological sciences. Offered alternate years. Prerequisite: Junior standing.

BIOL 460 Advanced Microbiology 3 semester credits Review of the microbial world involving bacteria and viruses and their impact on human immune function, disease prevention, environmental and industrial applications, and microbial ecology. Designed for students interested in continuing in science, particularly in pharmacy and pre-med. Prerequisite: BIOL 140 and BIOL 217.

BIOL 468 Molecular Biology and Genetics 4 semester credits Structure and function of cells emphasizing molecular aspects at cellular, organelle, and physiological levels. Molecular composition of cell organelles, structure of eukaryotic genomes including chromosomes, recombination, gene structure and transcription, gene control during development, hormonal influence on gene expression, chemical synthesis, and factors influencing inheritance patterns. Emphasis is on animal cells. Includes lecture and laboratory hours. Prerequisite: BIOL 140 or equivalent; one semester of college chemistry.

BIOL 479 Cooperative Education 1, 3, 6 or 12 credits A planned and supervised work-learning experience in industry, business, government, or community service agencies related to the University program of study. Prerequisites: Cooperative Education 279 or Junior standing and approval of advisor, Chair/Dean of the College of Arts and Sciences, and cooperative education coordinator.

BIOL 506 Molecular Biology Techniques 3 semester credits Introduction to such techniques of molecular biology as electrophoresis and chromatography as these methodologies are employed in the fields of cytology, molecular genetics, and physiology. Graduate credit requirements are described in the course syllabus.

BIOL 507 Freshwater Biology 3 semester credits Examination, identification, and classification of a wide variety of freshwater organisms abundant in Montana's aquatic systems. Extensive laboratory work and field trips are required. Graduate credit requirements are described in the syllabus. Prerequisites: basic biology course.

BIOL 508 Flowering Plants of the Plains and Mountains 3 semester credits Study of flowering plants found in prairie, foothill, mountain, riparian, and aquatic habitats. Methods of collection, general identification, and

preservation of a series of plant specimens, including development of a herbarium, are included. Graduate credit requirements are described in the syllabus.

BIOL 515 Ecological Methods 3 semester credits Review of the various methodologies that are used by ecologists to examine the environment. Stresses laboratory and field procedures that are applicable to a classroom situation. They will be presented in conjunction with a review of the associated ecological concepts. Graduate credit requirements are described in the course syllabus. Prerequisite: Basic ecology course.

BIOL 568 Molecular Biology and Genetics 4 semester credits Structure and function of cells emphasizing molecular aspects at cellular, organelle, and physiological levels. Molecular composition of cell organelles, structure of eukaryotic genomes including chromosomes, recombination, gene structure and transcription, gene control during development, hormonal influence on gene expression, and chemical synthesis. Factors influencing the inheritance patterns. Emphasis on animal cells. Includes lecture and laboratory hours. Graduate credit requirements are described in the course syllabus. Prerequisite: BIOL 140 and equivalent college chemistry.

BIOL 635 Advanced Zoology 3 semester credits Characteristics, classification, identification, life history, and ecological distribution of North American mammals and freshwater fish. Laboratory hours are devoted largely to the recognition and identification of representative species. Prerequisite: Vertebrate Zoology course.

COURSE REVISION FORM

NEW _____ DROPPED _____ MAJOR REVISION _____ FOR INFORMATION ONLY X _____

College Arts & Science Program Area Chemistry Date 12/11/02

Submitter *M. Baer* Chair/Dean *M. Baer* Date 12/17/02
Signature Signature (indicates "college" level approval)

Please provide a brief explanation & rationale for the proposed revision(s):

Revise the course descriptions for the Chemistry program stating whether or not they meet the science laboratory requirement. All course descriptions to remain the same except for adding a sentence at the end of the description as shown below.

Please provide the following information:

College: **Arts and Sciences**
Program Area: **Chemistry**
Date: **December 11, 2002**

Course Prefix, No. & Course Title:	Sentence to be added to the end of the course description:
CHEM 111 General Chemistry	This course does meet the laboratory science requirement.
CHEM 112 Physiological Chemistry	This course does meet the laboratory science requirement.
CHEM 123 General Inorganic Chemistry I Lab	This course taken in conjunction with the lecture portion of the course (CHEM 121) meets the laboratory science requirement.
CHEM 124 General Inorganic Chemistry II Lab	This course taken in conjunction with the lecture portion of the course (CHEM 122) meets the laboratory science requirement.
CHEM 279 Cooperative Education	This course does not meet the laboratory science requirement.
CHEM 311 Quantitative Analysis	This course does meet the laboratory science requirement.
CHEM 312 Quantitative and Instrumental Analysis	This course does meet the laboratory science requirement.
CHEM 330 Biochemistry	This course does not meet the laboratory science requirement.
CHEM 331 Biochemistry II	This course does not meet the laboratory science requirement.
CHEM 343 Organic Chemistry I Lab	This course taken in conjunction with the lecture portion of the course (CHEM 341) meets the laboratory science requirement.
CHEM 344 Organic Chemistry II Lab	This course taken in conjunction with the lecture portion of the course (CHEM 342) meets the laboratory science requirement.

CHEM 351 Instrumental Analysis

This course does meet the laboratory science requirement.

CHEM 356 Physical Chemistry

This course does meet the laboratory science requirement.

CHEM 479 Cooperative Education

This course does not meet the laboratory science requirement.

Required by: Chemistry

Current Catalog Description (include all prerequisites):

Same-see attached

Proposed or New Catalog Description (include all prerequisites):

See above

Course Outcome Objectives:

N/A

Additional instructional resources needed (including library materials, special equipment, and facilities). Please note: approval does not indicate support for new faculty or additional resources.

ACAD course revision form 10-10-2001 rev. 12-12-01

CHEM 111 General Chemistry 3 semester credits General chemistry dealing primarily with physical states of matter, including nomenclature, atomic structure, chemical reactions, and acid-base theory. First of a two-semester sequence for majors that do not require a strong background in chemistry. Includes lecture and laboratory hours. **Course Fee: \$20.00**

CHEM 112 Physiological Chemistry 3 semester credits Basic topics in organic chemistry and biochemistry; chemistry as it relates to the human body--functional groups, nomenclature, categories of compounds, and reactions, metabolism, cellular processes, nutrition, and foods. Prerequisite: High School Chemistry or CHEM 111. Second of a two-semester sequence for majors that do not require a strong background in chemistry. Includes lecture and laboratory hours. **Course Fee: \$20.00**

CHEM 121 General Inorganic Chemistry I 3 semester credits Fundamental principles of inorganic chemistry: nomenclature, theoretical concepts of bonding, periodic trends, chemical reactions, state of matter, heat of reactions, gaseous nature, and free energy. Primarily for students planning to continue in chemistry and other fields requiring knowledge of chemical principles. Concurrent enrollment in CHEM 123 laboratory is required. Prerequisite: High School Algebra.

CHEM 122 General Inorganic Chemistry II 3 semester credits Fundamental principles of inorganic chemistry: equilibria processes, acid-base theories, pH, K_a , neutralization, buffers, precipitation, K_{sp} , family and row periodic element characteristics, nuclear processes, and environmental problems. Primarily for students planning to continue chemistry and related fields requiring knowledge of chemical principles. Concurrent enrollment in CHEM 124 laboratory is required. Prerequisites: CHEM 121 and CHEM 123.

CHEM 123 General Inorganic Chemistry I Lab 2 semester credit The laboratory portion of CHEM 121 dealing with experiments in nature of matter, gaseous state, heat of reactions, and other general principles of matter. Concurrent enrollment in CHEM 121 lecture is required. **Course Fee: \$22.00**

CHEM 124 General Inorganic Chemistry II Lab 2 semester credits The laboratory portion of CHEM 122 dealing with experiments in acid-base, pH, neutralization, and qualitative analysis. Laboratory techniques in the qual scheme are examined. Concurrent enrollment in CHEM 122 lecture is required. Prerequisite: CHEM 123. **Course Fee: \$25.00**

CHEM 279 Cooperative Education 1, 3, 6 or 12 semester credits A planned and supervised work-learning experience in industry, business, government, or community service agencies related to the University program of study. Prerequisites: Two semesters of attendance at Montana State University-Northern, approval of advisor, Chair/Dean of the College of Arts and Sciences, and cooperative education coordinator.

CHEM 311 Quantitative Analysis 4 semester credits Introduction to the theory and laboratory techniques of volumetric, gravimetric, and spectrophotometer methods of analysis. Prerequisite: CHEM 122 and CHEM 124. **Course Fee: \$20.00**

CHEM 312 Quantitative and Instrumental Analysis 4 semester credits Continuation of CHEM 311. Further examination of the theory and laboratory techniques of volumetric, gravimetric, and spectrophotometric methods of analysis. Examines the chemical principles dealing with nonaqueous processes, electrochemical principles, and instrumental techniques. Offered alternate years. Prerequisite: CHEM 311. **Course Fee: \$20.00**

CHEM 330 Biochemistry 3 semester credits Principles of modern biochemistry. Prerequisite: CHEM 341 or consent of instructor.

CHEM 331 Biochemistry II 3 semester credits Continuation of Biochemistry 330. Prerequisite: CHEM 330.

CHEM 341 Organic Chemistry I 3 semester credits Organic chemistry for science and related majors with emphasis on the structure of molecules, chemical and physical properties, and reactions mechanisms of hydrocarbons, alkyl halides, and alcohols. Examines the nature of alkanes, alkenes, alkynes, cyclic alkanes, and aromatic hydrocarbon compounds. Concurrent enrollment in CHEM 343 Organic Laboratory I is required. Prerequisites: CHEM 122 and CHEM 124.

CHEM 342 Organic Chemistry II 3 semester credits Examination of molecules, their chemical and physical properties, reactions mechanisms of ether, carboxylic acids and their derivatives, aldehydes, ketones, amines, aryl halides, phenolic compounds, and introduction into biochemistry. Concurrent enrollment in CHEM 344 Organic Laboratory II is required. Prerequisite: CHEM 341.

CHEM 343 Organic Chemistry I Lab 2 semester credits Laboratory portion of Organic Chemistry I. Experiments in organic techniques of distillation, extraction, and recrystallization, preparation and identification of hydrocarbons, alcohol, cyclic alkanes, and alkyl halides compounds. Concurrent enrollment in CHEM 341 is required. Prerequisite: CHEM 124. **Course Fee: \$25.00**

CHEM 344 Organic Chemistry II Lab 2 semester credits Laboratory portion of Organic Chemistry II. Preparation and identification of ether, carboxylic acid, esters, amines, aldehydes, ketone, other compounds, and reaction mechanisms. Concurrent enrollment in CHEM 342 is required. Prerequisite: CHEM 343. **Course Fee: \$25.00**

CHEM 351 Instrumental Analysis 3 semester credits Modern methods of chemical analysis with emphasis on spectrometric, electrometric, and chromatographic techniques of analytical chemistry. Offered alternate years. Prerequisite: CHEM 311.

CHEM 356 Physical Chemistry 3 semester credits An introduction to Physical chemistry emphasizing the quantitative aspects of thermodynamics, kinetic processes, equilibrium situations, and electrochemical phenomena. Prerequisite: CHEM 311.

CHEM 479 Cooperative Education 1, 3, 6 or 12 semester credits A planned and supervised work-learning experience in industry, business, government, or community service agencies related to the University program of study. Prerequisites: Cooperative Education 279 or Junior standing and approval of advisor, Chair/Dean of the College of Arts and Sciences, and cooperative education coordinator.