

BIOL 493

Undergraduate Seminar

Preparation and presentation of seminars on topics of current interest in biology. Topic changes by semester; see class schedule. May be repeated to a maximum of three credits. Prerequisites: Two years of biological sciences and consent of instructor. 1 credit.

BIOL 494

Biology Colloquium

Analysis and critique of topics as presented by speakers drawn from the national biological research community. May be repeated to a maximum of three credits. S/F grading only. Prerequisite: Two years of biological sciences. 1 credit.

BIOL 496

Advanced Topics in Modern Biology

Advanced study in a specialized area of biology. Topics selected and published in class schedule. Maximum of three different topics may be selected for a total of six credits. Prerequisites: BIOL 196, BIOL 197 and consent of instructor. 1-3 credits.

BIOL 498

Scientific Presentations

Seminar for undergraduate students conducting research projects on any biological discipline. Gives students advice and provides them with practical experience on giving oral and written presentations. Discussion of principles of good visual communication and demonstrations of good and poor selections. Prerequisites: BIOL 196, BIOL 197 and consent of instructor 1-2 credits.

BIOL 499

Instruction in Biological Sciences

Significant involvement in instruction of courses in biological sciences. May include laboratory preparation, instruction, and grading. May be repeated to a maximum of two credits. S/F grading only. Prerequisite: Consent of instructor. 1-2 credits.

Department of Chemistry

Purpose and Focus

The science of chemistry deals with the composition, analysis, structure, and properties of matter and the various transformations matter may undergo. Chemical processes are at the heart of many diverse systems that are of great interest to mankind, including biological functions, the natural and polluted environment, industrial processes, biotechnology, food and agriculture, mining technology, etc. The Bachelor of Arts degree is designed to allow a student sufficient flexibility to obtain expertise in a discipline other than chemistry so that chemical knowledge can be applied to another field. The Bachelor of Science degree is an accredited program that requires more chemistry, math, and physics than the Bachelor of Arts degree and is intended for students wishing to pursue a career in chemistry. The Bachelor of Science degree in Biochemistry is intended to provide a student with the theoretical and technical skills necessary for employment in industry or to pursue a graduate degree in biochemistry or a related field.

Degree Objectives/Learning Outcomes

Objectives of the Bachelor of Arts Degree in Chemistry:

1. Graduates shall be able to demonstrate technical competency in the performance of basic laboratory operations, including solution preparation and standardization, common synthetic procedures, standard qualitative and quantitative analysis procedures, and operation of standard laboratory equipment.
2. Graduates shall understand the concepts underlying the theoretical basis of chemistry, as well as areas of application of chemical principles.
3. Graduates shall be capable of critical analysis and, under supervision, shall be able to apply the scientific method to a chemical problem.
4. Graduates must be well versed in the language of chemistry, should be capable of accessing chemical information in its various forms, and should be capable of effectively communicating chemical knowledge in both written and oral forms.

Objectives of the Bachelor of Science Degree in Chemistry:

1. Graduates shall be able to demonstrate technical competency in the performance of basic laboratory operations, including solution preparation and standardization, common synthetic procedures, standard qualitative and quantitative analysis procedures, and operation of standard laboratory equipment.
2. Graduates shall have an in-depth understanding of the theoretical basis of chemistry, as well as areas of application of chemical principles.
3. Graduates shall be capable of critical analysis and shall have had experience in applying the scientific method to a chemical problem.
4. Graduates must be well versed in the language of chemistry and should be capable of effectively communicating chemical knowledge in both written and oral forms.

5. Graduates shall be able to function as chemical professionals in entry-level jobs or to succeed in graduate studies in chemistry or related scientific fields.

Objectives of the Bachelor of Science Degree in Biochemistry:

1. Graduates shall be able to demonstrate technical competency in the performance of basic laboratory operations, including solution preparation and standardization, common synthetic procedures, standard qualitative and quantitative analysis procedures, and operation of standard laboratory equipment.
2. Graduates shall have an in-depth understanding of the theoretical basis of biochemistry, as well as areas of application of chemical principles.
3. Graduates shall be capable of critical analysis and shall have had experience in applying the scientific method to a chemical problem.
4. Graduates must be well versed in the language of biochemistry and should be capable of effectively communicating chemical knowledge in both written and oral forms.
5. Graduates shall be able to function as chemical professionals in entry-level jobs or to succeed in graduate studies in biochemistry or related scientific fields.

Accreditation

Northwest Commission on Colleges and Universities
American Chemical Society (B.S. in Chemistry)

Undergraduate Majors

Biochemistry-Bachelor of Science
Chemistry-Bachelor of Arts
Chemistry-Bachelor of Science

Areas of Concentration

Education
Environmental Chemistry

Early Admit Fast-Track Program with UNLV — School of Dental Medicine

This program expedites the process of earning a doctor of dental medicine degree. Students admitted to the program complete three years of prerequisite course work at UNLV. Following completion of the second year, students take the DAT and apply to UNLV — School of Dental Medicine (UNLV-SDM) through the Associated American Dental School Application Service (AADSAS). Participation in this early-admit program does not guarantee acceptance following completion of the second year of undergraduate study. Students who are admitted to UNLV-SDM matriculate following completion of the third year at UNLV. Course work completed at UNLV-SDM during the first year is transferred to UNLV to complete the Bachelor of Arts in Chemistry. The net result is reduction of the time required to earn the baccalaureate and DMD degrees from eight years to seven. To learn more about the specific details of this program, please contact the pre-health advisor.

Early Admit Fast-Track Program with Touro University — College of Osteopathic Medicine

This program expedites the process of earning an osteopathic medical degree. Students admitted to the program complete three years of prerequisite course work at UNLV. Following completion of the second year, students take the MCAT and apply to Touro University — College of Osteopathic Medicine (TU-COM) through the Association of American Colleges of Osteopathic Medicine Application Service (AACOMAS). Participation in this Early Admit Program does not guarantee acceptance following completion of the second year of undergraduate study. Students who are admitted to TU-COM matriculate following completion of the third year at UNLV. Course work completed at TU-COM during the first two years is transferred to UNLV to complete the Bachelor of Arts in Chemistry. The net result is reduction of the time required to earn the baccalaureate and medical degrees from eight years to seven. To learn more about the specific details of this program, please contact the pre-health advisor.

Minor

Chemistry (24 credits)

Includes CHEM 121 and 122 plus 16 additional credits of chemistry in courses numbered 220 or higher. At least 12 credits must be upper division. Credit will not be allowed toward the total of 24 for completing both CHEM 220 and CHEM 241. See departmental policies (below) for further details.

Certification and Licensure Programs

Secondary Teacher Certification: Students wishing to obtain teaching certification in chemistry should contact the College of Education Advising Center (CEB 144) for requirements.

Admission to the Major

Minimum GPA: 2.50

Admissions Policies: Students must meet minimum GPA requirements.

Probationary admission is provided for those students with a GPA between 2.30 and 2.49. See the Departmental Policies and College of Sciences sections for further details.

Transfer Policies: Transfer students should first have their transcripts evaluated by the Office of the Registrar & Admissions, then schedule a meeting with the College of Sciences Advising Center. Based on the transcripts and catalog descriptions, equivalencies to UNLV courses will be determined and a plan for completion of the degree developed. In cases of questions regarding the transferability of a particular course, satisfactory performance (i.e., a grade of C or better) by a student in a higher numbered UNLV chemistry course for which the proposed UNLV transfer course is a prerequisite shall be accepted as proof that the student has mastery of the course content and the student shall be awarded transfer credit.

Department Policies

Academic Policies: Majors may count no more than one grade of D in chemistry courses toward meeting degree requirements. Chemistry courses taken more than eight years prior to the proposed date of graduation are subject to review by the department, and at the discretion of the department, such courses may not be allowed for application to a degree program. Students potentially affected by this policy should meet with the department chair.

Minors: No grade lower than a C (i.e., C- and below) may be applied to a chemistry minor. Credit toward the minor will not be allowed for both CHEM 220 and CHEM 241. At least nine credits must be earned at UNLV.

Nonchemistry Majors: Nonchemistry majors who seek rigorous preparation in chemistry for medical school, graduate school in other fields, or research positions should consider the sequence CHEM 121, 122, 241, 241L, 242, 242L, and possibly CHEM 421 and 474–475.

Probation: Students on probation must meet with their advisor to devise a course of study that, when successfully completed, will remove the student from probationary status; the course of study must be approved by the department chair. The course of study shall consist of at least 15 units that apply toward a degree in the major; ordinarily, the course of study will be required to be completed in one calendar year (i.e., two semesters and the summer term). The advisor may request that completion time be extended by one semester for good cause (e.g., more than 15 units in the course of study, course offering schedules, etc.). Failure to satisfactorily complete the probationary course of study is grounds for suspension from the department and the College of Sciences.

Advisement

See College of Sciences Advisement section for details.

Degree Requirements

Biochemistry — B.S.

- 1) English Composition6 credits
ENG 101 and ENG 102
- 2) English Literature3 credits
ENG 231 or 232
- 3) Constitutions 4-6 credits
- 4) Mathematics8 credits
MATH 181, 182
- 5) Distribution Requirement
Life & Physical Sciences & Analytical Thinking (exempt)
Humanities and Fine Arts9 credits
Social Science9 credits
- 6) Multicultural (see notes)
International (see notes)
- 7) Degree Requirements:
Physics8 credits
PHYS 151, 152 (see notes)
Sciences 1 credit
SCI 101

Biology 25 credits
BIOL 189, 196, 197, 300 and at least nine credits from
BIOL 350, 351, 409, 440, 442, 447, 448, 453, 460, 465,
466, 468, 470, 473, 485 and CHEM 478

Chemistry 48-49 credits
CHEM 121, 122, 241, 242, 347, 348, 355, 355L, 402,
421, 422, 455, 455L, 472, 474, 475, 476, 491, and three
additional credits of upper-division chemistry.

Electives 36-38 credits
Total: 124-127 credits

Notes:

1. The sequence PHYS 180-180L, 181-181L, and 182-182L is an acceptable replacement for PHYS 151,152; any two course combination from PHYS 180, 181, and 182 is not an acceptable replacement.
2. Every student must complete a three-credit multicultural course and a three-credit international course. Courses satisfying other requirements may simultaneously satisfy the multicultural and international requirements except one course cannot satisfy both the multicultural and the international requirements.
3. At least 40 credits must be earned at the upper-division level (300 and above).

Chemistry — B.A.

- 1) English Composition6 credits
ENG 101 and ENG 102
- 2) English Literature3 credits
ENG 231 or 232
- 3) Constitutions 4-6 credits
- 4) Mathematics8 credits
MATH 181, 182
- 5) Distribution Requirement
Life & Physical Sciences & Analytical Thinking (exempt)
Humanities and Fine Arts9 credits
Social Science9 credits
- 6) Multicultural (see notes)
International (see notes)
- 7) Degree Requirements:
Computer Science 3 credits
CS 117 or 135
Physics8 credits
PHYS 151, 152 (see notes)
Sciences 1 credit
SCI 101

Chemistry Major Requirements 35 credits
CHEM 121, 122, 241, 242, 347, 348, 355, 355L, 402,
421, 491, and eight credits (including at least two credits
of advanced laboratory) selected from 312, 422, 423, 428,
431, 442, 447, 455, 455L, 472, 474, 475, 490, or 492

Electives 36-38 credits
Total: 124 credits

Notes:

1. The sequence PHYS 180-180L, 181-181L, and 182-182L is an acceptable replacement for PHYS 151,152; any two-course combination from PHYS 180, 181, and 182 is not an acceptable replacement.
2. Every student must complete a three-credit multicultural course and a three-credit international course. Courses satisfying other requirements may simultaneously satisfy the multicultural and international requirements except one course cannot satisfy both the multicultural and the international requirements.
3. At least 40 credits must be earned at the upper-division level (300 and above).

Chemistry — B.A. Concentration in Education, Minor in Education

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|--|-----------------|
| 1) English Composition | 6 credits |
| ENG 101 and ENG 102 | |
| 2) English Literature | 3 credits |
| ENG 231 or 232 | |
| 3) Constitutions | 4-6 credits |
| 4) Mathematics | 8 credits |
| MATH 181, 182 | |
| 5) Distribution Requirement | |
| Life & Physical Sciences & Analytical Thinking (exempt) | |
| Humanities and Fine Arts | 9 credits |
| Social Science | 9 credits |
| EPY 303 and two approved courses | |
| 6) Multicultural | 3 credits |
| ICG 280 | |
| International | (see notes) |
| 7) Degree Requirements: | |
| Computer Science | 3 credits |
| CS 117 or 135 | |
| Physics | 8 credits |
| PHYS 151, 152 (see notes) | |
| Sciences | 1 credit |
| SCI 101 | |
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| Chemistry Major Requirements | 35 credits |
| CHEM 121, 122, 241, 242, 347, 348, 355, 355L, 402, 421, 474, 455, 455L, and 491 | |
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| Teaching Certificate Requirements | 15 credits |
| BIOL 189, 196, GEOL 101, ENV 101 | |
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| Minor in Education Requirements | 34 credits |
| EPY 303, ESP 444, ICG 280, ICS 201, 328, 330, 414, 428, 450 and 460. Students must also place out of Nevada School Law or take EDA 200. Information regarding the placement test is available with the College of Education Advising Center (CEB 144). | |
| Electives | 2-7 credits |
| Total | 132-135 credits |

Notes:

1. The sequence PHYS 180-180L, 181-181L, and 182-182L is an acceptable replacement for PHYS 151,152; any two-course combination from PHYS 180, 181, and 182 is not an acceptable replacement.

2. Every student must complete a three-credit multicultural course and a three-credit international course. Courses satisfying other requirements may simultaneously satisfy the multicultural and international requirements except one course cannot satisfy both the multicultural and the international requirements.
3. At least 40 credits must be earned at the upper-division level (300 and above).
4. This degree confers Teaching Certification in Chemistry, Physical Science, and General Science. Students earning this degree are qualified to teach Chemistry, Biology, Earth Science, and Physical Science.

Chemistry — B.S.

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|--|---------------|
| 1) English Composition | 6 credits |
| ENG 101 and ENG 102 | |
| 2) English Literature | 3 credits |
| ENG 231 or 232 | |
| 3) Constitutions | 4-6 credits |
| 4) Mathematics | 16 credits |
| MATH 181, 182, 283, 431 | |
| 5) Distribution Requirement | |
| Life & Physical Sciences & Analytical Thinking (exempt) | |
| Humanities and Fine Arts | 9 credits |
| Social Science | 9 credits |
| 6) Multicultural | (see notes) |
| International | (see notes) |
| 7) Degree Requirements: | |
| Statistics | 3 credits |
| STAT 152, or 411-412, or 491-492 | |
| Physics | 12 credits |
| PHYS 180-180L, 181-181L, 182-182L | |
| Sciences | 1 credit |
| SCI 101 | |
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| Chemistry | 54-57 credits |
| CHEM 121, 122, 241, 242, 347, 348, 355, 355L, 402, 421, 422, 423, 428, 431, 447, 455, 455L, 474, 491, 493, 494 and two courses selected from CHEM 312, 442, 472, 475, 476, 492 | |
| Electives | 3-5 credits |
| Total | 124 credits |

Notes:

1. German or Russian is strongly recommended. Up to six credits of foreign language may be used to satisfy the General Education Core Humanities requirement.
2. Every student must complete a three-credit multicultural course and a three-credit international course. Courses satisfying other requirements may simultaneously satisfy the multicultural and international requirements except one course cannot satisfy both the multicultural and the international requirements.
3. At least 40 credits must be earned at the upper-division level (300 and above).

Chemistry

CHEM 103

Preparatory Chemistry

For students with a deficiency in high school chemistry who wish to qualify for CHEM 121. Credit not allowed in both CHEM 103 and 110. Does not satisfy the General Education Core Science requirement. Corequisite: Enrollment in MATH 096 or placement in MATH 124 or higher. 3 credits.

CHEM 105

Chemistry, Man, and Society

Introduction to chemistry, intended to develop an understanding of basic principles, and an appreciation of both the benefits and risks resulting from application of these principles in science and technology. May be used in partial fulfillment of the General Education Core Science requirement. Credit not allowed in both CHEM 105 and 110. 3 credits.

CHEM 106

Beginning Chemistry Laboratory

Laboratory exercises designed to illustrate material discussed in CHEM 105. May be used in partial fulfillment of the General Education Core requirement. Must be concurrently enrolled in CHEM 105. 1 credit.

CHEM 110

Chemistry for the Health Sciences I

Survey of elementary principles of general chemistry and their applications to living systems. For students in programs such as nursing and allied health. Three hours lecture and three hours laboratory. Credit not allowed in both CHEM 103 and 110. Prerequisite: MATH 096 or placement in MATH 124 or higher. 4 credits.

CHEM 111

Chemistry for the Health Sciences II

Survey of elementary principles of organic chemistry and biochemistry. For students majoring in nursing and allied health. Three hours lecture and three hours laboratory. Credit not allowed in both CHEM 111 and 220. Prerequisite: CHEM 110. 4 credits.

CHEM 121

General Chemistry I

Fundamental principles of chemistry and their correlation with the properties of the elements. Three hours lecture and three hours laboratory. Corequisite: MATH 127 or 128 or higher. Prerequisites: A passing score on the Chemistry Placement Exam or a grade of C or better in CHEM 103. 4 credits.

CHEM 122

General Chemistry II

Application of chemical principles to properties of inorganic substances. Includes principles and techniques of qualitative analysis, with special emphasis on applications of chemical equilibria. Three hours lecture and three hours laboratory. Prerequisites: CHEM 121, and MATH 127 or MATH 128 or higher. 4 credits.

CHEM 123

Qualitative Analysis Laboratory

Laboratory portion of CHEM 122. One hour lecture and three hours laboratory. Open only to students with scores of four or five on the Chemistry Advanced Placement Test of the College Entrance Examination Board. Satisfies CHEM 121-122 for these students. Prerequisite: A score of four or five on the Advanced Placement Test in Chemistry. 2 credits.

CHEM 190

Freshman Independent Study in Chemistry

Introduction to research in a chemistry lab. Students work under close supervision of a faculty member to develop research skills. May include library research and laboratory work. May be repeated to a maximum of three credits. Prerequisites: CHEM 121 or a score of three or better on the AP Chemistry Exam; consent of faculty member directing the research prior to registration. 1 credit.

CHEM 220

Introductory Organic Chemistry

Introduction to the properties of organic functional groups and to elementary laboratory techniques. Three hours lecture and three hours laboratory. Credit toward meeting chemistry program requirements not allowed in both CHEM 220 and CHEM 241. Prerequisite: CHEM 122. 4 credits.

CHEM 241

Organic Chemistry I

Intensive introduction to the theory of carbon chemistry with particular emphasis on understanding the relationship between the structure and behavior of organic molecules. Credit toward meeting chemistry program requirements not allowed in both CHEM 220 and CHEM 241. Prerequisite: CHEM 122. 3 credits.

CHEM 241L

Organic Chemistry for Life Sciences Lab I

Laboratory exercises in introductory organic chemistry. Stereochemistry, separation and purification techniques, micro-scale organic reaction procedures. Corequisite: CHEM 241. 1 credit.

CHEM 242

Organic Chemistry II

Continuation of CHEM 241 with emphasis on complex reactions and mechanisms, and introduction to advanced approaches for the synthesis of organic molecules. Credit not allowed in both CHEM 220 and CHEM 241-242. Prerequisite: CHEM 241. 3 credits.

CHEM 242L

Organic Chemistry for Life Sciences Laboratory II

Laboratory exercises in intermediate organic chemistry with continued emphasis on micro-scale organic reaction procedures. Introduction to the identification of organic compounds using chemical and instrumental means (qualitative analysis). Corequisite: CHEM 242. 1 credit.

CHEM 302**Chemistry Demonstrations for Science Teachers**

Provides an opportunity for science teachers to perform practical chemistry demonstrations and to review fundamental chemical principles. These demonstrations suitable for incorporation into the physical, biological, and earth science curricula. Prerequisites: Consent of instructor and either a teaching certificate or bachelor's degree. 2 credits.

CHEM 312**Introduction to Radiochemistry**

Introduction to the fundamental principles of radiation science for radiochemists. Introduction to radioactivity, interaction of radiation with matter, and effects of radiation on biological systems. Discussion and overview of practical applications of radiochemistry, including nuclear medicine, radiochemical techniques, nuclear chemical engineering, and radioactive waste management. Prerequisites: CHEM 122, PHYS 181, MATH 182. 3 credits.

CHEM 347**Laboratory Techniques of Organic Chemistry I**

Laboratory exercises in introductory organic chemistry for chemistry majors. Stereochemistry, separation and purification techniques, macro-scale organic reaction procedures. Corequisite: CHEM 241. 1 credit.

CHEM 348**Laboratory Techniques of Organic Chemistry II**

Laboratory exercises in intermediate organic chemistry with continued emphasis on macro-scale reaction procedures. Introduction to advanced purification, separation, qualitative analysis, and spectroscopic techniques. Corequisite: CHEM 242. 2 credits.

CHEM 355**Quantitative Analysis**

Theory and techniques of quantitative analysis, particularly gravimetric, titrimetric, complexometric, potentiometric, and colorimetric methods. Standard chromatographic and spectroscopic techniques also covered. Emphasis upon chemical calculations and equilibrium considerations. Three hours lecture. Prerequisites: CHEM 220 or CHEM 241 plus either CHEM 241L or 347. 3 credits.

CHEM 355L**Quantitative Analysis Laboratory**

Laboratory stressing the application and techniques of quantitative analysis, particularly gravimetric, titrimetric, complexometric, potentiometric, and calorimetric methods. Standard chromatographic and spectroscopic techniques also covered. Emphasis upon chemical calculations and equilibrium considerations as applied to chemical analysis. Students must be concurrently enrolled in CHEM 355. Six hour laboratory. Prerequisites: CHEM 220; or CHEM 241 plus either CHEM 241L or 347; and concurrent enrollment in CHEM 355. 2 credits.

CHEM 402**Scientific Software for the Microcomputer**

Use of computer software for graphing, statistics, structure drawing, information retrieval, word processing, and self-paced learning. Prerequisites: CHEM 242. 1 credit.

CHEM 421**Physical Chemistry I**

Thermodynamics, solution behavior, and equilibrium. Prerequisites: CHEM 122 and PHYS 152 or concurrent registration in PHYS 182 and MATH 182. 3 credits.

CHEM 422**Physical Chemistry II**

Kinetic theory, chemical kinetics, electrochemistry, introductory quantum chemistry, and states of matter. Prerequisite: CHEM 421. 3 credits.

CHEM 423**Physical Chemistry Laboratory**

Introduction to basic physicochemical laboratory techniques and their use in elucidating chemical theory. CHEM 423 and CHEM 493 may not be taken concurrently. Corequisite: CHEM 422. Prerequisite: CHEM 421. 2 credits.

CHEM 428**Quantum Chemistry**

Introduction to quantum mechanics and molecular orbital theory as related to bonding, spectra, and reactivity. Includes an introduction to computerized electronic structure calculations. Prerequisites: CHEM 422, MATH 182 and PHYS 181 or 182. 3 credits.

CHEM 431**Advanced Inorganic Chemistry**

Atomic and molecular structure: acid-base theory; periodic relationships and organometallic chemistry. Corequisite: CHEM 422. 3 credits.

CHEM 442**Advanced Organic Chemistry**

Builds on the background of the one-year organic chemistry course. Emphasizes advanced concepts of reactivity, single-step and multistep transformations, important named reactions, as well as mechanistic and functional group approaches to synthesis. Prerequisite: CHEM 242. 3 credits.

CHEM 447**Advanced Synthesis Laboratory**

Preparation, purification, and characterization of organic and inorganic compounds. Six hours laboratory. Prerequisites: CHEM 242. 2 credits.

CHEM 455**Instrumental Analysis**

Fundamental laws and principles of instrumental determinations, including spectroscopy, spectrophotometry, electrochemical methods, and thermal analysis as main areas of study. Three hours lecture. Prerequisite: CHEM 355 and CHEM 355L. Corequisite: CHEM 421. 3 credits.

CHEM 455L**Instrumental Analysis Laboratory**

Laboratory stressing the application and techniques of instrumental analysis including spectroscopy, spectrophotometry, electrochemical methods, and thermal analysis and the use of these methods in chemical analysis. Two credit, six hours laboratory. Prerequisites: CHEM 355, CHEM 355L and concurrent enrollment in CHEM 455. 2 credits.

CHEM 472**Biochemistry Laboratory**

Introduction to analytical techniques of biochemistry as tools to study cellular components. Techniques may include centrifugation, spectrophotometry, chromatography, and electrophoresis. Six hours laboratory. Prerequisites: CHEM 474, Biochemistry major. 2 credits.

CHEM 474**Biochemistry I**

Fundamentals of biochemistry with emphasis on the structure-function relationships of proteins, enzymes, carbohydrates, lipids and nucleic acids; bioenergetics; and intermediary metabolism and the mechanisms of its regulation. Prerequisite: CHEM 242. 3 credits.

CHEM 475**Biochemistry II**

Continuation of CHEM 474 with emphasis on anabolic and catabolic pathways; gene replication and expression in prokaryotes and eukaryotes; recombinant DNA; and various aspects of physiological chemistry. Prerequisite: CHEM 474. 3 credits.

CHEM 476**Advanced Topics in Biochemistry**

In-depth study of selected topics of current and general interest in biochemistry. Topics may include enzymes, nucleic acids, metabolism, molecular genetics, neurochemistry, toxicology, and human biochemistry. Prerequisite: CHEM 475. 2-3 credits.

CHEM 478**Endocrinology**

(Same as BIOL 448.) Survey of the structure and function of vertebrate endocrine systems, with emphasis on the biochemical basis of hormone action and the role of cell communication in endocrine physiology. Prerequisite: CHEM 474 recommended. 3 credits.

CHEM 490**Senior Independent Study in Chemistry**

Modest research projects for students working toward the Bachelor of Arts degree and demonstrating aptitude for independent work. May be repeated once. No more than three credits of CHEM 490 may be applied toward a chemistry degree. Prerequisite: Consent of the faculty member directing the project must be obtained prior to registration. 1-3 credits.

CHEM 491**Senior Seminar in Chemistry**

Topics of current research in all fields of chemistry; matters of professional concern. Includes presentation of oral and written papers. May be repeated to a maximum of two credits. Prerequisites: CHEM 355, 402, and 421. 1 credit.

CHEM 492**Advanced Topics in Chemistry**

Selected topics from the various disciplines of chemistry not covered by any other course offerings and of current interest to students and faculty. May be repeated to a maximum of four credits. Prerequisite: CHEM 242. 1-2 credits.

CHEM 493**Senior Research in Chemistry I**

Individual laboratory projects drawn from any field of chemistry. Preliminary library work, equipment acquisition, and apparatus assembly and initiation of laboratory work as time allows. May be repeated to a maximum of two credits. Prerequisites: (Consent of the faculty member directing the project must be obtained prior to registration.) For students in the general B.S. in Chemistry program, prerequisites are CHEM 242, 422, 423, and 455. For students in the Biochemistry B.S. program, prerequisites are CHEM 355, 472, and 475; Corequisite CHEM 421. 1 credit.

CHEM 494**Senior Research in Chemistry II**

Continuation of CHEM 493. Intensive experimental work. May be repeated to a maximum of four credits. Prerequisite: CHEM 493. 2 credits.