

CHEMISTRY AND BIOCHEMISTRY (CHE)

CHE 101 Introductory Chemistry 3

Survey of fundamentals of measurement, molecular structure, reactivity, and organic chemistry; applications to textiles, environmental, consumer, biological, and drug chemistry.

MAC: MAC Nat Sci Data Analysis

Notes: For elementary education, business, and liberal arts majors. Students cannot receive credit for both CHE 101 and either CHE 111 or CHE 103; CHE 110 is recommended as corequisite.

CHE 103 General Descriptive Chemistry I 3

Chemistry course for pre-health, pre-nursing, pre-kinesiology and students building a foundation for CHE 111. Topics include states of matter, atomic and molecular structure, stoichiometry, solutions, and nuclear chemistry.

MAC: MAC Nat Sci Data Analysis

Corequisites: CHE 110 must be taken concurrently unless student takes CHE 104 or CHE 111 later.

Notes: Not open to students who have already taken CHE 111.

CHE 104 General Descriptive Chemistry II 3

Applications of the principles introduced in CHE 103 to representative organic and biological systems. Topics include introductory organic and biochemical concepts.

Prerequisites: CHE 103 or permission of instructor.

Corequisites: CHE 110 must be taken concurrently unless taken with CHE 103.

CHE 110 Introductory Chemistry Laboratory 1

Designed to acquaint non-science majors with basic laboratory practices.

Corequisites: To be taken concurrently with either CHE 103 or CHE 104. Also may accompany CHE 101.

CHE 111 General Chemistry I 3

Fundamental principles of chemistry, including stoichiometry, atomic structure, and states of matter.

MAC: MAC Nat Sci Data Analysis

Prerequisites: One year of high school chemistry or CHE 103. students lacking high school chemistry should take the sequence CHE 103, CHE 111, CHE 114; Prerequisite or

Corequisites: CHE 112.

CHE 112 General Chemistry I Laboratory 1

Laboratory work to accompany CHE 111. Prerequisite or

Corequisites: CHE 111.

CHE 114 General Chemistry II 3

Continuation of CHE 111 with attention to ionic equilibria, elementary kinetics and thermodynamics, acid-base theory, coordination chemistry, and electrochemistry.

MAC: MAC Nat Sci Data Analysis

Prerequisites: CHE 103, CHE 104, and CHE 110 with performance in each at the B level or higher, or CHE 111, CHE 112. Prerequisite or

Corequisites: CHE 115.

Notes: Designed primarily for science majors and is the prerequisite to upper level courses in chemistry.

CHE 115 General Chemistry II Laboratory 1

Laboratory work to accompany CHE 114.

Prerequisites: CHE 112 or equivalent. Prerequisite or

Corequisites: CHE 114.

CHE 150 Succeed in Chemistry and Biochemistry 3

A foundations course specifically for chemistry and biochemistry majors focusing on the students' successful transition to UNCG. This course will connect students to the campus community and to relevant chemistry/ biochemistry resources by combining university transition content, information literacy, and transferable skills acquisition to facilitate academic and personal development.

MAC: MAC Foundations

CHE 170 Engaging with Chemistry and Biochemistry 1

Introduction to careers with a chemistry or biochemistry foundation, and to successful academic approaches to preparing for those careers.

Prerequisites: Chemistry or Biochemistry majors.

CHE 191 Introduction to Research 1

Introduction to the basic concepts of research, involving multistep experiments and discussion of research opportunities.

Corequisites: CHE 114.

CHE 205 Introductory Organic Chemistry 3

A course in organic chemistry designed for students whose programs require only one semester in this area.

Prerequisites: CHE 104, CHE 110. or CHE 114, CHE 115;

Corequisites: CHE 206.

CHE 206 Introductory Organic Chemistry Laboratory 1

Laboratory work to accompany CHE 205.

Corequisites: CHE 205.

CHE 252 Chemistry and the Human Environment 3

Study of chemical problems central to current technological, biomedical, and environmental issues. Topics include energy alternatives, food chemicals, environmental chemistry, molecular basis of drug action, and consumer products.

MAC: MAC Health and Wellness

Prerequisites: CHE 101, CHE 104, or CHE 114 or permission of instructor.

CHE 291 Sophomore Research 1-3

Sophomore-level research in chemistry and biochemistry. Participation in a research project directed by a faculty supervisor.

Prerequisites: CHE 114 and CHE 115.

Notes: May be repeated for credit for up to 3 s.h.

CHE 292 Sophomore Research 1-3

Sophomore-level research in chemistry and biochemistry. Participation in a research project directed by a faculty supervisor.

Prerequisites: CHE 114 and CHE 115.

Notes: May be repeated for credit for up to 3 s.h.

CHE 331 Quantitative Analysis 3

Introduction to the theory and practice of volumetric and gravimetric methods of analysis.

Prerequisites: CHE 114, CHE 115.

Corequisites: All students must take CHE 333 concurrently unless they have previous credit for an equivalent course.

CHE 333 Quantitative Analysis Laboratory 1

Laboratory work to accompany CHE 331.

CIC: CIC College Writing

Corequisites: CHE 331 must be taken concurrently.

CHE 342 Inorganic Chemistry I 3

Introduction to theoretical principles, structure, and reactivity of main group metals and nonmetals and transition metals including industrial, bioinorganic and organometallic chemistry, and inorganic materials and nanomaterials.

Prerequisites: CHE 114.

CHE 351 Organic Chemistry I 4

Chemistry of aliphatic and aromatic compounds with attention to reaction mechanisms and synthetic applications, and the application of spectroscopy to structure determination.

Prerequisites: CHE 114.

Corequisites: CHEM and BCHE majors: CHE 353.

Notes: May not be taken more than twice.

CHE 352 Organic Chemistry II 3

Continuation of CHE 351 with attention to alcohols, ethers, aldehydes and ketones, carboxylic acids and derivatives, amines, lipids, carbohydrates, and organic spectroscopy.

Prerequisites: Grade of C or better in CHE 351.

Corequisites: CHEM and BCHE majors must take CHE 355 concurrently.

Other students must take CHE 354 concurrently unless they have previous credit for an equivalent course.;

Notes: May be repeated only once.

CHE 353 Organic Laboratory Techniques 1

Basic techniques for organic chemistry laboratory, with introduction of separation, characterization, and analysis of organic compounds including use of instrumental methods. To accompany CHE 351 for chemistry and biochemistry majors.

Prerequisites: CHEM or BCHE major. previous credit for CHE 351 or concurrent enrollment in CHE 351.

CHE 354 Organic Chemistry Laboratory 1

Laboratory work to accompany CHE 352.

CHE 355 Intermediate Organic Chemistry Lab 2

Advanced organic laboratory methods; modern reactions in synthesis; purification of compounds and characterization by spectroscopic instrumentation; qualitative organic analysis; chemical and biochemical literature; computational modeling; chemical database searching; safety resources.

Prerequisites: Chemistry or Biochemistry major. grade of C (2.0) or better in CHE 351 and CHE 353 or CHE 354;

Corequisites: CHE 352.

CHE 391 Junior Research 1-3

Junior-level research in chemistry and biochemistry. Participation in a research project directed by a faculty supervisor.

Prerequisites: CHE 352 and CHE 353 (or CHE 354) or CHE 331 and CHE 333 and permission of instructor.

Notes: May be repeated for credit for up to three (3) credits.

CHE 392 Junior Research 1-3

Junior-level research in chemistry and biochemistry. Participation in a research project directed by a faculty supervisor.

Prerequisites: CHE 352 with CHE 353 (or CHE 354) or CHE 331 with CHE 333. and permission of instructor;

Notes: May be repeated for credit for up to three (3) credits.

CHE 401 Chemistry Seminar Introduction 0

Preparation for seminar. Attendance at weekly seminars given by visiting speakers, faculty, and students.

Prerequisites: CHE 355 or CHE 372. CHEM or BCHE major; junior standing;

Notes: Grade: Pass/Not Pass (P/NP).

CHE 402 Chemistry Seminar 1

Oral reports and discussion of topics from the current chemistry literature by students, staff, and guest lecturers. Attendance at weekly seminars is required.

Prerequisites: CHE 401, senior standing.

CHE 406 Introductory Physical Chemistry 4

Study of the concepts basic to chemical kinetics, equilibrium, energetics, spectroscopy, solution phenomena, electrochemistry, and colloidal behavior with applications to biological systems. Theory of methods and instrumentation also examined.

Prerequisites: Two semesters of chemistry beyond general chemistry, MAT 292 or MAT 296, one year of physics.

Notes: Students cannot receive credit for both CHE 406 and CHE 461 toward an undergraduate degree.

CHE 407 Introductory Physical Chemistry Laboratory 1

Laboratory work related to CHE 406 with emphasis on mathematical treatment of experimental data and communication of results in report form.

CIC: CIC College Writing

Corequisites: CHE 406 .

CHE 420 Chemical Principles of Biochemistry 3

Introduction to major classes of biomolecules and to genetic and metabolic pathways in living systems; emphasis on chemical nature of biological processes and the driving forces that make them work.

Prerequisites: CHE 352. BIO 111 and BIO 112 strongly recommended.

CHE 427 Introduction to Medicinal Chemistry 3

The introduction to medicinal chemistry course introduces students to the process of drug discovery through an interdisciplinary look at the challenges faced in getting a small-molecule drug to market. After completing the introduction to drug discovery, students will learn about the medicinal chemistry of past, current, and future drug treatments.

Prerequisites: Grade of C or better in CHE 351 and CHE 352.

CHE 431 Instrumental Analysis 3

Theory and practice of advanced analytical techniques with emphasis on instrumental methods of analysis.

Prerequisites: CHE 331, CHE 333, CHE 205 or CHE 352 (either may be taken concurrently), PHY 212 or PHY 292.

CHE 433 Instrumental Analysis Laboratory 1

Laboratory work to accompany CHE 431.

CIC: CIC College Writing

Corequisites: CHE 431 must be taken concurrently.

CHE 436 Computational Chemistry 3

Survey of modern computational chemistry methods, including molecular mechanics, molecular dynamics simulations, conformational searching, and computational quantum mechanics.

Prerequisites: CHE 352, PHY 212 or PHY 292, or permission of instructor.

CHE 442 Inorganic Chemistry II 3

Modern concepts of chemical bonding and its application to inorganic reactions and periodic relationships.

Prerequisites: CHE 342, CHE 406 or CHE 461.

Corequisites: CHE 406 or CHE 461 may be taken concurrently.

CHE 453 Advanced Organic Chemistry I 3

Advanced topics in organic chemistry with special emphasis on reaction mechanisms and stereochemistry.

Prerequisites: CHE 352.

CHE 455 Organometallic Chemistry 2

Theoretical and synthetic aspects of organometallic chemistry and applications to catalysis and synthetic organic chemistry.

Prerequisites: CHE 352, CHE 442.

CHE 456 Biochemistry I 3

Introductory biochemistry presented from a chemical perspective. Topics include amino acids, proteins and enzymes, carbohydrates, nucleic acids, lipids, membranes, and carbohydrate catabolism.

Prerequisites: CHE 352, BIO 111, BIO 112.

CHE 457 Biochemistry II 3

Continuation of CHE 456. Enzyme catalytic mechanisms, additional topics in intermediary metabolism, genetic biochemistry, and selected topics in molecular physiology.

Prerequisites: CHE 456.

CHE 458 Biochemistry Laboratory 1

Introduction to biochemical techniques, including isolation, purification and characterization of biological molecules.

CIC: CIC College Writing

Prerequisites: CHE 456 (or equivalent), CHE 353 (or CHE 354), and CHE 333. or permission of instructor.

CHE 461 Physical Chemistry I 4

Chemical thermodynamics and equilibrium processes covered, including phase equilibria, thermodynamics of solutions, kinetics, and electrochemistry.

Prerequisites: MAT 292 or MAT 296 and PHY 292.

Notes: Students cannot receive credit for both CHE 461 and CHE 406 toward an undergraduate degree.

CHE 462 Physical Chemistry II 3

Subject material deals with microscopic world including introductions to quantum mechanics, molecular spectroscopy, and statistical mechanics.

Prerequisites: CHE 461 .

CHE 463 Physical Chemistry I Laboratory 1

Laboratory work related to CHE 461 with emphasis on mathematical treatment of experimental data and communication of results in report form.

CIC: CIC College Writing

Prerequisites: CHE 331, CHE 333.

Corequisites: CHE 406 or CHE 461.

CHE 464 Physical Chemistry II Laboratory 1

Additional laboratory work primarily in kinetics and the determination of molecular structure. This is a writing emphasis course.

CIC: CIC College Writing

Prerequisites: CHE 461, CHE 463.

Corequisites: CHE 462.

CHE 468 Introduction to Chemical Biology 3

Chemical biology is a field that seeks to use chemical insights and approaches to answer biological questions and generate new molecules. The breadth of topics will include bioorthogonal chemistry, biosynthesis, enzyme engineering, and genome editing.

Prerequisites: Grade of B- or better in CHE 351, CHE 352. CHE 420 or CHE 456, or permission of instructor.

CHE 470A Special Topics in Chemistry: Analytical 1-3

See CHE 470.

Prerequisites: Permission of instructor.

CHE 470B Special Topics in Chemistry: Biochemistry 1-3

See CHE 470.

Prerequisites: Permission of instructor.

CHE 470C Special Topics in Chemistry: Inorganic 1-3

Prerequisite: Permission of instructor.

CHE 470D Special Topics in Chemistry: Organic 1-3

See CHE 470.

CHE 470E Special Topics in Chemistry: Physical 1-3

See CHE 470.

CHE 470F Special Topics in Chemistry: Chemical Education 1-3

See CHE 470.

Prerequisites: Permission of instructor.

CHE 481 Synthetic Techniques 2

Theoretical discussion and laboratory practice in modern methods of synthesis in the areas of organic and inorganic chemistry. Emphasis given to regions of overlap such as organometallic chemistry.

CIC: CIC College Writing

Prerequisites: CHE 342, CHE 352, CHE 355.

CHE 490 Internship in Chemistry and Biochemistry 3

Practical experience in local industrial setting. Includes bi-weekly meeting with Departmental internship coordinator. Students must complete 12 hours a week at an internship site.

Prerequisites: CHE 333 and CHE 355. junior status; overall GPA of 3.0 or better; and permission of instructor .

CHE 491 Senior Research 1-3

Senior-level research in chemistry and biochemistry. Participation in a research project directed by a faculty supervisor.

Prerequisites: Three (3) years of chemistry or biochemistry and permission of instructor.

Notes: May be repeated for credit for a maximum of three (3) credits.

CHE 492 Senior Research 1-3

Senior-level research in chemistry and biochemistry. Participation in a research project directed by a faculty supervisor.

Prerequisites: Three (3) years of chemistry or biochemistry and permission of instructor.

Notes: May be repeated for credit for a maximum of three (3) credits.

CHE 493 Honors Work 3-6

Honors Work.

Prerequisites: Permission of instructor. 3.30 GPA in the major, 12 s.h. in the major;

Notes: May be repeated for credit if the topic of study changes.

CHE 499 Senior Thesis 1

Preparation of a thesis based on a student's undergraduate research.

Prerequisites: Senior standing, completion of five (5) semesters of undergraduate research, or permission of instructor.

Corequisites: CHE 492 for 2 or 3 s.h.

CHE 531 Instrumental Analysis 3

Theory and practice of advanced analytical techniques with emphasis on instrumental methods of analysis.

CHE 533 Instrumental Analysis Laboratory 1

Laboratory work to accompany CHE 531.

Corequisites: CHE 531 must be taken concurrently.

CHE 553 Advanced Organic Chemistry I 3

Advanced topics in organic chemistry with special emphasis on reaction mechanisms and stereochemistry.

CHE 555 Organometallic Chemistry 3

Theoretical and synthetic aspects of organometallic chemistry focusing on transition metal complexes and their applications to industrially important catalysis and to synthetic organic chemistry.

CHE 556 Biochemistry I 3

Introductory biochemistry presented from a chemical perspective. Topics include amino acids, proteins and enzymes, carbohydrates, nucleic acids, lipids, membranes, and carbohydrate catabolism.

CHE 557 Biochemistry II 3

Continuation of CHE 556. Enzyme catalytic mechanisms, additional topics in intermediary metabolism, genetic biochemistry, and selected topics in molecular physiology.

Prerequisites: CHE 556 or permission of instructor.

CHE 558 Biochemistry Laboratory 1

Introduction to biochemical techniques, including isolation, purification and characterization of biological molecules.

Prerequisites: CHE 556 (or equivalent) or permission of instructor.

CHE 570B Special Topics in Chemistry: Biochemistry 1-3

See CHE 570.

Prerequisites: Permission of instructor.

CHE 570C Special Topics in Chemistry: Inorganic 1-3

See CHE 570.

Prerequisites: Permission of instructor.

CHE 570D Special Topics in Chemistry: Organic 1-3

See CHE 570.

CHE 570E Special Topics in Chemistry: Physical 1-3

See CHE 570.

CHE 570F Special Topics in Chemistry: Chemical Education 1-3

See CHE 570.

Prerequisites: Permission of instructor.

CHE 601 Graduate Seminar I 1

Oral reports from the current literature of chemistry by the students, as well as attendance at presentations by other students, staff, and guest speakers.

Prerequisites: CHE 401 or equivalent.

CHE 602 Graduate Seminar II 1

Oral reports from the literature and the student's thesis research, as well as attendance at presentations by other students, staff, and guest speakers.

Prerequisites: CHE 601.

CHE 613 Teaching Chemistry: Theory and Practice 1

Introduction to teaching chemistry with emphasis on theory, practice, and techniques.

CHE 615 Entrepreneurship for the Sciences 3

Develop knowledge and skills in entrepreneurship to identify and evaluate science and technology ideas in chemistry and the life sciences as opportunities to take through the feasibility and business plan.

Notes: Students who have prior credit for ENT 615 may not take CHE 615 for credit.

CHE 623 Learning Theories in Chemistry 3

Introduction to the learning theories that inform chemistry education research, with the focus on how research findings regarding how humans learn chemistry can be applied to improve teaching and learning.

CHE 624 Survey of Natural Products Research 3

Survey of many different areas of natural products research, including taxonomy, genetics, nomenclature, biosynthesis, and process methods.

Prerequisites: Two courses in undergraduate organic chemistry and one course in undergraduate biochemistry.

CHE 627 Introduction to Medicinal Chemistry 3

Introduces students to the process of drug discovery through an interdisciplinary look at the challenges faced in getting a small-molecule drug to market. After completing the introduction to drug discovery, students will learn about the medicinal chemistry of past, current, and future drug treatments.

Prerequisites: Grade of C or better in CHE 351 and CHE 352 or an equivalent sequence of two semesters of organic chemistry lecture.

CHE 632 Advanced Analytical Chemistry 3

Current research activities in the analytical area, primarily for first year graduate students. Four areas emphasized: chemical equilibrium, spectroscopy, separations, and electrochemistry.

Prerequisites: CHE 462 or CHE 406 or equivalent. One semester of instrumental analysis (CHE 531) recommended.

CHE 633 Bioanalytical Chemistry 3

Comprehensive study on various analytical methods used to characterize nucleic acid and protein drug targets and their molecular interactions with therapeutic agents.

Prerequisites: Permission of instructor.

CHE 636 Computational Chemistry 3

Survey of modern computational chemistry methods, including molecular mechanics, molecular dynamics simulations, conformational searching, and computational quantum mechanics.

CHE 641 Advanced Inorganic Chemistry 3

Group theory, its applications, and other topics in advanced inorganic chemistry.

Prerequisites: CHE 442.

CHE 651 Structure Elucidation in Medicinal Chemistry 3

Use of structure elucidation in medicinal chemistry including drug design, chemistry of High Throughput Screening and focused libraries, lead development/optimization.

Prerequisites: Two courses in undergraduate organic chemistry and one course in undergraduate biochemistry.

CHE 652 Synthetic Organic Chemistry 3

Methods and problems in multi-step organic synthesis, including use of transition metal reagents and asymmetric synthesis. Applications in drug synthesis.

Prerequisites: Two courses in undergraduate organic chemistry.

CHE 656 Enzyme Mechanisms 3

Detailed look at how enzymes catalyze a broad range of chemical reactions. Particular emphasis on the role of organic cofactors and metal ions in catalysis.

Prerequisites: CHE 352 and either CHE 420 or CHE 556, or permission of instructor.

CHE 658 Nucleic Acid Biochemistry 3

Structure and functions of nucleic acid and their biochemical reactions with cellular proteins. Emphasis on the genomic approach to identify and validate drug targets.

Prerequisites: Permission of instructor.

CHE 659 Receptor Biochemistry 3

Structure and biochemical properties of the various cell-surface receptors. Emphasis on specific receptors chosen as drug targets for various diseases.

Prerequisites: One course in undergraduate biochemistry.

CHE 660 Biochemical Pharmacology and Disease Targets 3

Drug action at the biochemical and molecular level. Focus on the biochemical and cellular mechanisms of action that guide the drug discovery and development process.

Prerequisites: One course in undergraduate biochemistry.

CHE 661 Advanced Physical Chemistry I 3

Selected topics in quantum chemistry, spectroscopy, statistical thermodynamics, and chemical kinetics will be developed with attention to methods of application.

Prerequisites: CHE 461 and CHE 462 or equivalent (one year of physical chemistry).

CHE 663 Spectroscopy and Structure of Proteins and Nucleic Acids 3

Spectroscopic and structural methods for the study of biological macromolecules, particularly proteins and nucleic acids. Topics include absorption spectroscopy, circular dichroism, fluorescence, FTIR, NMR, EPR, and X-ray crystallography.

Prerequisites: CHE 406 or CHE 461, CHE 420 or CHE 556, or permission of instructor.

Notes: May be repeated for a maximum of 6 credits when topic varies.

CHE 668 Introduction to Chemical Biology 3

Chemical biology is a rapidly evolving field that seeks to use biological and chemical insights and approaches to answer biological questions and generate new molecules. The breadth of topics includes bioorthogonal chemistry, biosynthesis, enzyme engineering, and genome editing.

Prerequisites: Strongly recommend two courses in undergraduate organic chemistry, one course in undergraduate biochemistry, or permission of instructor.

CHE 670B Adv Special Topic Biochemistry 1-6**CHE 670D Adv Special Topic Organic 1-6****CHE 680 Research Problems in Chemistry and Biochemistry 1-6**

Advanced research in specialized areas of chemistry or biochemistry under the direction of a faculty member. Preparation for master's thesis.

Prerequisites: Permission of instructor and department head.

Notes: May be taken for credit over two or more semesters.

CHE 691 Introduction to Graduate Research 1

Guides new students in the selection of a research advisor. Professors present brief summaries of their research projects. Topics relevant to research are also discussed.

Prerequisites: Admitted to graduate program in department.

CHE 699 Thesis 1-6

Individual guidance in the development of a specific research problem.

Prerequisites: Approval of research proposal by thesis committee.

CHE 703 Instrumental Analysis 3

Theory and practice of advanced analytical techniques with emphasis on instrumental methods of analysis.

CHE 704 Instrumental Analysis Laboratory 1

Laboratory work to accompany CHE 703.

Corequisites: CHE 703.

CHE 705 Advanced Organic Chemistry I 3

Advanced topics in organic chemistry with special emphasis on reaction mechanisms and stereochemistry.

CHE 706 Organometallic Chemistry 3

Theoretical and synthetic aspects of organometallic chemistry focusing on transition metal complexes and their applications to industrially important catalysis and to synthetic organic chemistry.

CHE 707 Biochemistry I 3

Introductory biochemistry presented from a chemical perspective. Topics include amino acids, proteins and enzymes, carbohydrates, nucleic acids, lipids, membranes, and carbohydrate catabolism.

CHE 708 Biochemistry II 3

Continuation of CHE 707. Enzyme catalytic mechanisms, additional topics in intermediary metabolism, genetic biochemistry, and selected topics in molecular physiology.

Prerequisites: CHE 707 or permission of instructor.

CHE 709 Biochemistry Laboratory 1

Introduction to biochemical techniques, including isolation, purification and characterization of biological molecules.

Prerequisites: CHE 707 or equivalent or permission of instructor.

CHE 713 Teaching Chemistry: Theory and Practice 1

Introduction to teaching chemistry with emphasis on theory, practice, and techniques.

CHE 720 Introduction to Graduate Research 1

Guides new students in the selection of a research advisor. Professors present brief summaries of their research projects. Topics relevant to research are also discussed.

Prerequisites: Admitted to graduate program in department.

CHE 724 Survey of Natural Products Research 3

Survey of many different areas of natural products research, including taxonomy, genetics, nomenclature, biosynthesis, and process methods.

Prerequisites: Two courses in undergraduate organic chemistry and one course in undergraduate biochemistry.

CHE 732 Advanced Analytical Chemistry 3

Current research activities in the analytical area, primarily for first year graduate students. Four areas emphasized: chemical equilibrium, spectroscopy, separations, and electrochemistry.

Prerequisites: CHE 462 or CHE 406 or equivalent, one semester of instrumental analysis (CHE 703) recommended.

CHE 733 Bioanalytical Chemistry 3

Comprehensive study on various analytical methods used to characterize nucleic acid and protein drug targets and their molecular interactions with therapeutic agents.

Prerequisites: Permission of instructor.

CHE 736 Computational Chemistry 3

Survey of modern computational chemistry methods, including molecular mechanics, molecular dynamics simulations, conformational searching, and computational quantum mechanics.

CHE 741 Advanced Inorganic Chemistry II 3

Group theory, its applications, and other topics in advanced inorganic chemistry.

Prerequisites: CHE 442.

CHE 751 Literature Seminar 1

A literature-based seminar focusing on scientific literature databases and presentation skills.

Prerequisites: CHE 780.

CHE 752 Dissertation Seminar 1

A research-based seminar focusing on the student's dissertation research during the semester the student expects to graduate.

Prerequisites: CHE 780.

CHE 753 Structure Elucidation in Medicinal Chemistry 3

Use of structure elucidation in medicinal chemistry including drug design, chemistry of High Throughput Screening and focused libraries, lead development/optimization.

Prerequisites: Two courses in undergraduate organic chemistry and one course in undergraduate biochemistry.

CHE 754 Synthetic Organic Chemistry 3

Methods and problems in multi-step organic synthesis, including use of transition metal reagents and asymmetric synthesis. Applications in drug synthesis.

Prerequisites: Two courses in undergraduate organic chemistry.

CHE 756 Enzyme Mechanisms 3

Detailed look at how enzymes catalyze a broad range of chemical reactions. Particular emphasis on the role of organic cofactors and metal ions in catalysis.

Prerequisites: CHE 352 and either CHE 420 or CHE 707, or permission of instructor.

CHE 758 Nucleic Acid Biochemistry 3

Structure and functions of nucleic acid and their biochemical reactions with cellular proteins. Emphasis on the genomic approach to identify and validate drug targets.

Prerequisites: Permission of instructor.

CHE 759 Receptor Biochemistry 3

Structure and biochemical properties of the various cell-surface receptors. Emphasis on specific receptors chosen as drug targets for various diseases.

Prerequisites: One course in undergraduate biochemistry.

CHE 760 Biochemical Pharmacology and Disease Targets 3

Drug action at the biochemical and molecular level. Focus on the biochemical and cellular mechanisms of action that guide the drug discovery and development process.

Prerequisites: One course in undergraduate biochemistry.

CHE 761 Advanced Physical Chemistry I 3

Selected topics in quantum chemistry, spectroscopy, statistical thermodynamics, and chemical kinetics will be developed with attention to methods of application.

Prerequisites: CHE 461 and CHE 462 or equivalent (one year of physical chemistry).

CHE 763 Spectroscopy and Structure of Proteins and Nucleic Acids 3

Spectroscopic and structural methods for the study of biological macromolecules, particularly proteins and nucleic acids. Topics include absorption spectroscopy, circular dichroism, fluorescence, FTIR, NMR, EPR, and X-ray crystallography.

Prerequisites: CHE 406 or CHE 461, CHE 420 or CHE 707, or permission of instructor.

Notes: May be repeated for a maximum of 6 credits when topic varies.

CHE 770B Advanced Special Topics in Biochemistry 1-6

Advanced study in biochemistry.

Notes: Hours per week and credit to be arranged, may be repeated for a maximum of six credits when topic varies.

CHE 770D Advanced Special Topics in Organic Chemistry 1-6

Advanced study in organic chemistry.

Notes: Hours per week and credit to be arranged, may be repeated for a maximum of six credits when topic varies.

CHE 780 Research Problems in Chemistry and Biochemistry 1-24

Advanced research in specialized areas of chemistry and biochemistry under the direction of a faculty member. Research to be utilized for the preparation of the dissertation.

Prerequisites: Permission of instructor.

Notes: May be repeated for up to 24 hours.

CHE 790 Chemistry and Biochemistry Internship 3

Practical experience in a local industrial setting. Includes biweekly meetings with departmental internship coordinator.

Prerequisites: Permission of departmental internship coordinator and department head.

Notes: Student must complete a minimum of 12 hours per week at the internship site, may be repeated for up to 6 credits.

CHE 799 Dissertation Research in Chemistry and Biochemistry 1-12

Prerequisite: Permission of instructor;

Notes: Grade: Satisfactory/Unsatisfactory (S/U).

CHE 801 Thesis Extension 1-3

Thesis Extension.

CHE 802 Dissertation Extension 1-3

Dissertation Extension.

CHE 803 Research Extension 1-3

Research Extension.