

BIO 499. Senior Research in Biology (1-4 hours)

A special problem or research project will be arranged according to the qualifications of the student. The student should plan to extend this work over a period of at least two semesters, with the credit being assigned in the second semester. Credit hours to be determined by the nature of the problem or research, with a maximum of 4 credit hours for a single topic. No more than 4 credit hours of BIO 499 can apply toward the major. This project can also be used as part of an Honor Program in Biology.

BUSINESS (BUS)

For description of the courses offered in this area, and of the requirements for the minor (for Liberal Arts majors), see the section, EUGENE W. STETSON SCHOOL OF BUSINESS AND ECONOMICS, in this catalog.

CHEMISTRY (CHM)

Jeffrey D. Hugdahl, *Chair/Associate Professor*

Robert J. Hargrove, *Professor*

Joel A. Dopke, Nancy C. Dopke, Dale E. Moore, Andrew J. Pounds, Brian E. Rood, and Caryn S. Seney, *Associate Professors*

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The role of the Department of Chemistry is to foster the development of students in the understanding of the chemical foundations that are central to chemical, physical, and biological sciences. The Department of Chemistry offers a Bachelor of Science degree and contributes to the concentration in Biochemistry and Molecular Biology.

The Bachelor of Science major in chemistry consists of these courses totaling at least 38 semester credit hours: CHM 111/112 or 115; CHM 221, 222, 241, 311, 331, 332, 341, 371, 372, and 395; one course from CHM 411, 421, 431, 465, or 481; and two credit hours of lab chosen from CHM 401, 402, 465L, and 466L. Required courses from other departments include: MAT 191 and 192; PHY 161/121L and 162/162L. Successful completion of a senior comprehensive examination is required.

A student may elect a program that will result in American Chemical Society certification in chemistry or certification in chemistry with an emphasis in biochemistry. To meet the requirements for certification in chemistry, coursework must include: BIO/CHM 465; one advanced course chosen from CHM 411, 421, 431, 481; and CHM 401 and 402. For certification in chemistry with an emphasis in biochemistry, coursework must include: BIO/CHM 465 and 466; four credit hours of advanced lab chosen from CHM 401, 402, BIO/CHM 465L, and BIO/CHM 466L; and one additional course in Biology chosen from BIO 303, 310, and 460.

A minor in Chemistry consists of CHM 111/112 and at least seven additional credit hours in CHM courses numbered above 200; or CHM 115 and at least ten additional credit hours in CHM courses numbered above 200. No more than one credit hour of CHM 295 may be counted toward the minor requirement.

Departmental Honors in chemistry may be attained by fulfilling the following requirements: (1) select an honors faculty advisor in chemistry by the end of the semester in which one accumulates 96 semester credit hours and keep this advisor informed of progress toward satisfying the honors requirements; (2) complete the B.S. major in chemistry with a grade point average of 3.50 or above in the

major. (3) complete at least 4 semester credit hours of chemical research (CHM 401 and CHM 402) with a grade point average of 3.00 or above; and (4) write a paper of publishable quality on an approved topic of chemistry, using the format of the *Journal of the American Chemical Society*.

Secondary Teacher Certification Program in Chemistry

Teacher certification in chemistry (6-12) is available to chemistry majors who complete BIO 211 and 212 and BIO/CHM 465. Students planning to teach chemistry in secondary schools should notify their advisor and contact the secondary education advisor in Tift College of Education. Required courses in education include EDUC 210, 220, 256, 283, 357, 398, 399, 423, 469, 476, 485, and 492. Please consult the TIFT COLLEGE OF EDUCATION section of this catalog for more details. Georgia Professional Standards Commission approval of this new certification option is pending.

CHM 099. Chemistry Problem Solving (1 hour)

Corequisites: CHM 111 and MAT 133.

A support course taken in conjunction with General Chemistry I. This course provides explicit problem-solving instruction, focusing on learning and practicing those strategies appropriate to General Chemistry. Chemistry Problem Solving includes one weekly one-hour recitation meeting.

This course does not count toward the degree.

CHM 104. Household Chemistry (2 hours)

Prerequisite: SCI 105.

An introduction to properties of chemical substances found in the home. Concrete examples of everyday household materials are used to formulate the theoretical framework used in modern chemistry. The chemist's practice of categorizing materials into groups and grouping reactions into a small number of varieties will be developed. The nature and reactivity of materials will be emphasized. The course is taught as an eight-week module with lectures and laboratories.

CHM 108. Concepts of Chemistry (4 hours)

This course is designed for non-science majors. Emphasis is given to the application of a limited number of fundamental chemical concepts emphasizing the chemistry of life-systems and problems concerned with humanity, the environment, and the chemical industry. An attempt is made to demonstrate the manner in which a chemist unravels the mysteries of nature, rather than the development of technical proficiency. The course includes three one-hour lectures and one three-hour laboratory each week.

CHM 111. General Chemistry I (4 hours)

Prerequisite: MAT 133 or equivalent, or coenrollment in CHM 099.

CHM 111 is the first course in a two-part sequence that introduces students to the fundamental principles of chemistry. It studies matter and its transformation in chemical reactions. The states of matter, stoichiometry, equilibrium, and acid-base chemistry are treated in detail and are explained on the basis of atomic structure, chemical bonding, molecular geometry, and the kinetic molecular theory. Laboratory work introduces volumetric and simple analytical techniques in chemistry. The course includes three one-hour lectures and one three-hour laboratory each week.

CHM 112. General Chemistry II (4 hours)

Prerequisite: a grade of C or better in CHM 111.

CHM 112 is the second course in a two-part sequence that introduces students to the foundational principles of chemistry. Students will be exposed to the theoretical and experimental bases of thermodynamics, kinetics, oxidation-reduction reactions, and quantum mechanics. Within this framework, the concepts of thermochemistry, free energy, reaction rates, electrochemistry, and bonding theory will be developed. The course includes three one-hour lectures and one three-hour laboratory each week.

CHM 115. Advanced General Chemistry (5 hours)

Co- or prerequisite: MAT 191.

CHM 115 is an accelerated general chemistry course that seeks to unify many of the themes in General Chemistry to develop a comprehensive understanding of the subject. Students in CHM 115 will be introduced to the microscopic and macroscopic descriptions of matter and its behavior. They will be exposed to the fundamental laws of mass and energy conservation and their application to chemical systems and reactions. Students will also be introduced to the fundamentals of chemical thermodynamics and its bearing on equilibrium in gases, acids and bases, and ionic solutions. The course includes three one-hour lectures, one three-hour laboratory, and one one-hour computational recitation each week.

CHM 221. Organic Chemistry I (4 hours)

Prerequisite: CHM 112 or CHM 115.

A study of the chemistry of carbon compounds. The various functional groups and their transformations are studied systematically. Reaction mechanisms and the formulation of synthetic schemes are emphasized. Basic theory and interpretation of ultraviolet/visible, infrared, and nuclear magnetic resonance spectroscopies and mass spectrometry are discussed. Laboratory work involves the separation, preparation, and both chemical and instrumental analysis of organic compounds. The course includes three one-hour lectures and one three-hour laboratory each week.

CHM 222. Organic Chemistry II (4 hours)

Prerequisite: a grade of C or better in CHM 221.

A continuation of CHM 221. The course includes three one-hour lectures and one four-hour laboratory each week.

CHM 241. Quantitative Analysis (3 hours)

Prerequisite: CHM 112 or CHM 115.

A study of classical methods of analysis, stressing the quantitative aspects of chemistry. Emphasis is given to the treatment of analytical data (including error analysis). A thorough study of equilibria as it pertains to acid/base, precipitation, complexation, and redox phenomena is included. An introduction to quantitative spectroscopy, as it pertains to atomic absorption and ultraviolet/visible spectral methods, is given. Laboratory work includes gravimetric, volumetric, atomic absorption, ultraviolet/visible, and simple potentiometric methods of analysis. The course includes two one-hour lectures and one four-hour laboratory per week.

CHM 295. Chemical Research (1-2 hours)

Prerequisites: approval of department chair and a faculty research director.

Participation in an independent research problem directed by one or more faculty members. One hour credit will be awarded for three hours per week per semester of satisfactory participation. A maximum of two credits can be earned per

semester. This course may be repeated for a maximum of six semester credit hours. Attendance at departmental seminars and a seminar paper are required for each research topic taken.

CHM 311. Inorganic Chemistry (3 hours)

Prerequisite: CHM 221.

A survey of the chemistry of the elements, including main group, transition metal, and organometallic compounds in both inorganic and biological systems. An examination of acid-base and redox properties of these compounds is included. This course presents the structure, bonding, and reactivity of inorganic compounds through three one-hour lectures each week.

CHM 331. Quantum and Statistical Mechanics (3 hours)

Prerequisites: CHM 112 or 115, MAT 192, PHY 162/162L.

An introduction to quantum mechanical and statistical thermodynamic models. The principles and applications of quantum chemistry are introduced, including exactly soluble models, and atomic and molecular spectra. Properties of matter are interpreted by application of statistical mechanics to populations of atoms and molecules. Both segments of the course entail rigorous application of numerical methods to problems in physical chemistry. Course meetings include three one-hour lecture periods per week.

CHM 332. Reaction Dynamics (3 hours)

Prerequisites: CHM 112 or 115, MAT 192.

An introduction to the thermodynamic and kinetic influences on chemical and biochemical reactions. Course topics include laws of thermodynamics, phase equilibria, chemical equilibria, kinetic theory, empirical kinetics, and reaction mechanisms. Examples are drawn primarily from process chemistry and biochemistry. Course meetings include three one-hour lecture periods per week.

CHM 341. Instrumental Analysis (3 hours)

Prerequisites: CHM 222, 241.

A study of the instruments that are used for separation (such as gas chromatography and high performance liquid chromatography) and spectroscopic methods of analysis (including infrared, ultraviolet/visible, nuclear magnetic resonance, atomic absorption, atomic emission, and mass spectrometry). Attention is given to the block diagrams and the basic theory of the various instruments.

CHM 351. Environmental Chemistry (4 hours)

(Same as EES 351)

Prerequisite: CHM 241.

A study of the physiochemical properties of substances that determine their fate and transport in the environment. Inorganic and organic substances will be examined as they are deposited, transported, transformed, and stored in the soil/sediment, water, and atmosphere. Techniques for the sampling and analysis of nutrients, toxic metals, and organic priority pollutants will be examined. A lecture, laboratory, and field course.

CHM 371. Problems in Chemistry I (2 hours)

Prerequisites: CHM 222 and 241, MAT 192, PHY 162/162L.

Corequisites: CHM 331 and 341.

This laboratory capstone course features a set of experimental projects designed to integrate concepts and techniques from the major divisions of chemistry, pre-

senting chemistry as a unified science. Formal written laboratory reports are required. The course includes two three-hour laboratory meetings each week.

CHM 372. Problems in Chemistry II (2 hours)

Prerequisite: CHM 371.

A continuation of CHM 371, this laboratory capstone course features a set of experimental projects designed to integrate concepts and techniques from the major divisions of chemistry, presenting chemistry as a unified science. Formal written laboratory reports are required. The course includes two three-hour laboratory meetings each week.

CHM 395. Chemistry Seminar (1 hour)

Prerequisite: CHM 222.

A seminar series consisting of meetings to discuss articles in all areas of chemistry from the current chemical literature. Students will prepare presentations on primary research articles and serve as discussion leaders. The course includes one one-hour seminar per week. This course may be repeated for a maximum of two hours of credit.

CHM 401. Senior Research I (1-2 hours)

Prerequisites: senior status and departmental approval.

Independent research directed by a faculty member. Students work toward laboratory research goals prepared in consultation with a faculty mentor. Written and oral presentations are required. The course includes approximately six hours in the laboratory each week.

CHM 402. Senior Research II (1-2 hours)

Prerequisites: CHM 401 and departmental approval.

Independent research directed by a faculty member. Students work toward laboratory research goals prepared in consultation with a faculty mentor. Written and oral presentations are required. The course includes approximately three hours in the laboratory each week.

CHM 411. Advanced Inorganic Chemistry (3 hours)

Prerequisites: CHM 311, CHM 332, senior status, and departmental approval.

A survey of the advanced chemical theories applied to the interpretation of the relationship between chemical structure and observable properties of inorganic materials, including quantum mechanical description of atomic and bonding models. Special attention is given to the structure and bonding, the characterization, and the representative chemistry of transition metal compounds. The course includes three one-hour lectures each week.

CHM 421. Advanced Organic Chemistry (3 hours)

Prerequisites: CHM 332 and 341, senior status, and departmental approval.

A course devoted to topics in organic chemistry more advanced than those covered in CHM 222 and centered upon the relationship between structure and reactivity of organic molecules. Mechanistic and synthetic strategies are discussed, utilizing original literature and experimental data as a basis. The course includes three one-hour lectures each week.

CHM 431. Advanced Quantum Chemistry (3 hours)

Prerequisites: CHM 331, senior status, and departmental approval.

A course devoted to topics in quantum chemistry more advanced than those covered in CHM 331. The principles of operators and observables are presented,

along with eigenvalues, eigenvectors, superpositions, expectation values and matrix elements. Techniques from linear algebra will be applied to solving modern quantum mechanical problems, and modern computational methods will be used as appropriate. The course includes three one-hour lectures each week.

CHM 465. Biochemistry I (3 hours)

(Same as BIO 465)

Prerequisites: CHM 222 and BIO 212.

A course on the nature of the chemical and physiochemical properties of living organisms. Includes an overview of the synthesis and structure of biological macromolecules, enzyme kinetics, mechanisms of reactions, metabolism, and energy exchange. This course includes three one-hour lectures per week.

CHM 465L. Biochemistry I Laboratory (1 hour)

(Same as BIO 465L)

Corequisite: CHM/BIO 465.

Investigative laboratory component to complement CHM/BIO 465. Techniques used include electrophoresis, analysis of enzyme kinetics, chromatography, centrifugation, and protein analysis and centrifugation. Experimental design and formal laboratory writing are required. The course includes one four-hour laboratory each week.

CHM 466. Biochemistry II (3 hours)

(Same as BIO 466)

Prerequisite: CHM/BIO 465.

A continuation of CHM/BIO 465 covering the chemistry of cellular metabolism. Topics include biosynthesis and degradation of lipids, amino acids, and nucleotides; photosynthesis; the chemistry of DNA and RNA; and the concepts of molecular physiology. The course includes three one-hour lectures each week.

CHM 466L. Biochemistry II Laboratory (1 hour)

(Same as BIO 466L)

Corequisite: CHM/BIO 466.

Investigative laboratory component to complement CHM/BIO 466. The course focuses on the analytical tools used in the modern biochemical laboratory. Experimental design and formal laboratory writing are required. The course includes one four-hour laboratory each week.

CHM 481. Selected Topics in Chemistry (Subtitle) (1-4 hours)

Prerequisites: CHM 331, CHM 332, senior status, and departmental approval.

A study of a topic in much greater depth than is done in the more general courses. The particular topic will be selected by joint consultation between the department, the instructor, and the students registering for the course. The number of lectures and laboratories will depend on the topic.

CHRISTIANITY (CHR)

Richard Francis Wilson, *Chair/Professor*

Margaret Dee Bratcher and Walter Byron Shurden, *Professors*

Darlene Kaye Flaming, Paul Allen Lewis, and Robert Scott Nash, *Associate Professors*

Janell Anne Cook Johnson, *Assistant Professor*

Bryan Jay Whitfield, *Instructor*