BIOCHEMISTRY COURSES (16+ cr.)

BBMB 101 (1 cr.) ***Introduction to Biochemical Activities***
Career opportunities in biochemistry. Current research in biochemistry and an introduction to structure function of biochemical compounds.

BBMB 102 (1 cr.) ***Introductory Laboratory in Biochemistry***
Topics in the scientific background of biochemistry, such as macromolecules, metabolism and catalysis. May include laboratory experiments as well as literature readings and discussion. A significant component is practice in scientific communication.

BBMB 201 (2 cr.) ***Chemical Principles in Biological Systems***
Survey of chemical principles as they apply in biological systems including: water, organic chemistry of functional groups in biomolecules and biochemical cofactors, weak bonds and their contribution to biomolecular structure, oxidation-reduction reactions and redox potential, thermodynamic laws and bioenergetics, chemical equilibria and kinetics, inorganic chemistry in biological systems, data presentation. The subjects will be taught using molecules from biological systems as examples.

BBMB 404 (3 cr.) ***General Biochemistry***
Chemistry of amino acids, proteins, carbohydrates, lipids and vitamins; protein structure;
OR enzymology; carbohydrate metabolism.

BBMB 420 (3cr.) ***Physiological Chemistry***
Structure and function of proteins;enzymology;biological oxidation;chemistry and metabolism of carbohydrates,lipids,amino acids and nucleic acids; protein synthesis and the genetic code; relationship of biochemistry to selected animal diseases. Biochemistry of higher animals emphasized.

BBMB 411 (4 cr.) ***Biochemical Research Techniques***
Introduction to laboratory techniques for studying biochemistry including: chromatographic methods, electrophoresis, spectrophotometry, enzyme kinetics, and characterization of carbohydrates, proteins, lipids, and nucleic acids.

BBMB 461 or 561 (2 cr.) ***Molecular Biophysics***
Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for graduate credit commits the student to graduate-level examinations, which differ from the undergraduate-level examinations in the number and/or difficulty of questions.

BBMB 561L (2 cr.) ***Molecular Biophysics Laboratory***
Practice in methods of X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence
OR spectroscopy as applied to macromolecules. Must be concurrently enrolled in BBMB461/561.

CHEM 322L (3 cr.) ***Laboratory in Physical Chemistry***
Error analysis; use of computer; thermodynamics of gases; transport properties; thermochemistry; thermodynamics of phase equilibrium; chemical kinetics; polymers; molecular spectroscopy; x-ray crystallography; nuclear chemistry; surface chemistry; mass spectrometry.

BBMB 499 (variable) ***Independent Undergraduate Research***
Involvement in undergraduate research in one of the department's research laboratories is highly valued but not required.

CHEMISTRY COURSES (24+ cr.)

CHEM 201 (5 cr.) ***Advanced General Chemistry*** **-** concurrent enrollment in CHEM201L is required.
Principles and quantitative relationships, stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. Electro-chemistry, acid-base equilibria, thermodynamics, nuclear chemistry, and descriptive topics (non-metals, transition metals, coordination compounds, organic compounds, polymers, biological molecules). Concurrent enrollment in CHEM201L is required.
CHEM 177, 177L, 178 can be substituted for CHEM 201 + 201L.

CHEM 201L (1 cr.) ***Laboratory in Advanced General Chemistry***

CHEM 211 (2 cr.) ***Quantitative and Environmental Analysis***

Theory and practice of elementary volumetric,chromatographic, electrochemical and spectrometric methods of analysis. Chemical equilibrium, sampling, and data evaluation. Emphasis on environmental analytical chemistry; the same methods are widely used in biological and materials sciences as well. Must be taken with CHEM 211L.

CHEM 211L (2 cr.) ***Quantitative Analysis Laboratory***

Introductory laboratory experience in volumetric, spectrometric, electrochemical and chromatographic methods of chemical analysis. Accompanies CHEM 211.

CHEM 331 and CHEM 332 (3 cr. ea.) ***Organic Chemistry I and II***

Modern organic chemistry including nomenclature, synthesis, structure and bonding, reaction mechanisms, natural products, carbohydrates and proteins.

CHEM 324 and CHEM 325 (3 cr. ea.) ***Physical Chemistry I and II***

Classical thermodynamics 1st, 2nd, and 3rd laws with applications to gases and interfacial systems, multi-component, multi-phase equilibrium of reacting systems, surface chemistry, and electrochemical cells. Kinetic theory of gases; transport properties, chemical kinetics; quantum mechanics, atomic and molecular structure, spectroscopy, statistical thermodynamics, solids.

BBMB 561L (2 cr.) ***Molecular Biophysics Laboratory***

Practice in methods of X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence
OR spectroscopy as applied to macromolecules. Must be concurrently enrolled in BBMB461/561.

CHEM 322L (3 cr.) ***Laboratory in Physical Chemistry***

Error analysis; use of computer; thermodynamics of gases; transport properties; thermochemistry; thermodynamics of phase equilibrium; chemical kinetics; polymers; molecular spectroscopy; x-ray crystallography; nuclear chemistry; surface chemistry; mass spectrometry.

MATHEMATICS, COMPUTER SCIENCE, PHYSICS and STATISTICS COURSES (33+cr.)

MATH 165 and MATH 166 (4 cr. ea.) ***Calculus I and II***

Functions, limits, continuity, differentiation, derivatives of vector-valued functions, applications of derivatives. Integration, applications of the integral, matrices, differentiation of functions of several variables.

MATH 265 (4 cr.) ***Calculus III***

Multiple integrals, vector fields and vector integrals, sequences and series.

MATH 266 (3 cr.) ***Elementary Differential Equations***

Solution methods for ordinary differential equations. First order equations, linear equations, constant coefficient equations. Elgenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis.

MATH 207 (3 cr.) ***Matrices and Linear Algebra***

Systems of linear equations, determinants, vector spaces, orthogonality, linear
OR transformations, eigenvalues and eigenvectors. Emphasis on methods and techniques.

MATH 317 (4 cr.) ***Theory of Linear Algebra***

Systems of linear equations, determinants, vector spaces, inner product spaces, linear transformations, eigenvalues and eigenvectors. Emphasis on writing proofs and results.

Choose one of the following:

MATH 481 (3 cr.) ***Numerical Solution of Differential Equations and Interpolation***

Knowledge of a programming language. Polynomial and spline interpolation, orthogonal polynomials, least squares, numerical differentiation and integration, numerical solution of ordinary differential equations.

STAT 407 (3 cr.) ***Methods of Multivariate Analysis***

Techniques for displaying and analyzing multivariate data including plotting high-dimensional data using interactive graphics, comparing group mean vectors using Hotelling's T2, multivariate analysis of variance, reducing variable dimension with principal components, grouping/classifying observations with cluster analysis and discriminant analysis.

STAT 430 (3 cr.) ***Empirical Methods for the Computational Sciences***

Statistical methods for research involving computers; exploratory data analysis; selected topics from analysis of designed experiments-analysis of variance, hypothesis testing, interaction among variables; linear regression, logistic regression, Poisson regression; parameter estimation, prediction, confidence regions, dimension reduction techniques, model diagnostics and sensitivity analysis; Markov chains and processes; simulation techniques and bootstrap methods; applications to computer science, bioinformatics, computer engineering programs, models and systems as objects of empirical study; communicating results of empirical studies. Statistical software; R.

COM S 207 (3 cr.) ***Programming I***

An introduction to computer programming using an object-oriented programming language.

PHYS 221 and PHYS 222 (5 cr. ea.) ***Introduction to Classical Physics I and II***

Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Electric forces and fields. Electrical currents; DC circuits. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; waves and sound; ray optics and image formation; wave optics: heat, thermodynamics, kinetic theory of gases; topics in modern physics. *Laboratories are included*.

TAT 305 (3 cr.) ***Engineering Statistics***

OR

Statistics for problem solving. Principles of engineering data collection; descriptive statistics; elementary probability distributions; principles of experimentation; confidence intervals and significance tests; one-, two-, and multi-sample studies; regression analysis; use of statistical software; team project involving engineering experimentation and data analysis.

STAT 231 (4 cr.) ***Probability and Statistical Inference for Engineers***

Emphasis on engineering applications. Basic probability; random variables and probability distributions; joint and sampling distributions. Descriptive statistics; confidence intervals; hypothesis testing; simple linear regression; multiple linear regressions; one way analysis of variance; use of statistical software.

BIOLOGY COURSES (7 cr.)

BIOL 211 and BIOL 212 (3 cr. ea.) ***Principles of Biology I and II***

Introduction to the nature of life, including the cellular basis of life; the nature of heredity; evolution; diversity of microbial, plant, and animal life; form and function of microbial, plant, and animal life; principles of ecology; energy relationships.

BIOL 211L or BIOL 212L (1 cr.) ***Biology Laboratory***

Laboratory to accompany one of the biology courses

ELECTIVES (3 cr.)

Three additional credits in courses numbered above 300 are required in biochemistry, biophysics, biological sciences, chemistry or physics.

COLLEGE REQUIREMENTS (28 + cr)

ENGLISH PROFECIENCY:

ENG 150
ENG 250 (min. grade C)
Library 160 1 cr.
ENG 305 or 309 or 314; or BBMB 411 (80% min. grade on two journal-style reports)

GENERAL EDUCATION:

12 cr. Arts and Humanities as outlined in the LAS college requirements
9 cr. Social Sciences from two disciplines as outlined in the LAS college requirements
3 cr. Each U.S. Diversity and International Perspectives selected from a university-wide approved list.

WORLD LANGUAGE:

All majors in the College of Liberal Arts and Sciences must meet the world language requirement. To meet the requirement a student must have completed either:

-one year of university–level study in any one language
-three or more years of high school study in one foreign language
-pass exam for credit at the 102 level
-receive a passing grade in a 200 level or higher course