

# DEPARTMENT OF CHEMISTRY

## Chair

Dr. Tanea Reed  
(859) 622-1456  
Science Building 4126

## Faculty

K. Abdelhay, A. Akmeemana, J. Fredericks, P. Gao, J. Jenkins, A. Matheyambath, J. May, M. Ndinguri, T. Reed, L. Rowe, C. Tran, B. Wicker, L. Zyzak

## Bachelor's

- Chemistry, Bachelor of Science with a Concentration in Biochemistry (ACS Certification Optional) (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-concentration-biochemistry-ac-s-bs/>)
- Chemistry, Bachelor of Science with a Concentration in Biochemistry (ASBMB Certification) (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-concentration-biochemistry-bs/>)
- Chemistry, Bachelor of Science with a Concentration in Chemistry (ACS Certification) (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-concentration-ac-s-bs/>)
- Chemistry, Bachelor of Science with a Concentration in Chemistry (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-concentration-bs/>)
- Chemistry, Bachelor of Science with a Concentration in Chemistry Teaching (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-concentration-teaching-bs/>)
- Chemistry, Bachelor of Science with a Concentration in Pre-Health (Pre-Medical, Pre-Dental, Pre-Optometry, Pre-Physician Associate) (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-concentration-prehealth-bs/>)
- Chemistry, Bachelor of Science with a Concentration in Pre-Pharmacy (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-concentration-prepharmacy-bs/>)
- Forensic Science, Bachelor of Science with a Concentration in Forensic Biology (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/forensic-science-concentration-biology-bs/>)
- Forensic Science, Bachelor of Science with a Concentration in Forensic Chemistry (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/forensic-science-concentration-chemistry-bs/>)

## Accelerated

*No results were found.*

## Minor

- Chemistry/Teaching, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/chemistry-teaching-minor/>)
- Forensic Science, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/forensic-science-minor/>)

## Certificate

- Fermentation Science, University Certificate (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/fermentation-science-university-certificate/>)
- Fermentation, Departmental Certificate (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/chemistry/fermentation-departmental-certificate/>)

## Courses

### Chemistry

#### CHE 100. Inquiry Chemistry for Middle School Teachers. (3 Credits)

A. Prerequisite: completion of all academic readiness requirements in English and reading or completion of ENG 101R and Math ACT score of 19 or higher, Math SAT score of 500 or higher, or passing score on the math placement test, or MAT 105 or higher; pre-teaching or teaching middle school, special education, and DHH education majors only, Activity oriented chemistry; elements, molecules, solutions, acids and bases, reactions, energy and environmental topics. 2 Lec/2 Lab. Gen. Ed. E-4 [NS].

#### CHE 101. Introductory Chemistry. (3 Credits)

I, II. Prerequisite: completion of all academic readiness requirements in English and reading or completion of ENG 101R; and Math ACT score of 19 or higher, or passing score on math placement test, or Math SAT score of 500 or higher, or MAT 105 or higher. Corequisite: CHE 101L. For students who plan to take no more than one year of chemistry. Basic principles of structure and properties of matter, chemical nomenclature and reactivity. Relates chemistry concepts to everyday life phenomena. A withdrawal from CHE 101 must be matched by a withdrawal from CHE 101L. Gen. Ed. E-4 with CHE 101L [NS].

#### CHE 101L. Introductory Chemistry Lab. (1 Credit)

I, II. Prerequisite: completion of all developmental requirements in English and reading. Prerequisite or Corequisite: CHE 101. Laboratory component of CHE 101. Basic laboratory techniques, methods of separation, types of chemical reactions, solution preparation, titrations, household chemicals, molecular modeling. 2 Lab. Gen. Ed. IVB with CHE 101. Credit will not be awarded for both CHE 101L and CHE 107.

#### CHE 102. Introductory Chemistry II. (3 Credits)

I, II. Prerequisite: CHE 101 and 101L or CHE 111 and 111L. Prerequisite or Corequisite: CHE 102L. Continuation of CHE 101. A survey on the classes of organic molecules including their common uses and physical and chemical properties. In addition, an introductory look at the structure and function of biological macromolecules. Gen. Ed. VII (NS) with CHE 102L. Withdrawal from CHE 102 must be matched by a withdrawal from CHE 102L.

#### CHE 102L. Introductory Chemistry Lab II. (1 Credit)

I, II. Prerequisite: CHE 101 and 101L. Prerequisite or Corequisite: CHE 102. Lab component of CHE 102. Perform basic organic reactions and laboratory procedures including melting point, distillation, and recrystallization. 2 Lab. Gen. Ed. VII (NS) with CHE 102.

**CHE 104. Inquiry Physical Science for Elementary Teachers. (3 Credits)**

I, II. Cross-Listed with PHY 104. Prerequisite: Elementary, special education elementary, and DHH elementary education majors only, sophomore standing, and MAT 112 or 112B or higher. An activity-oriented conceptual course in the physical sciences. Topics include the structure and properties of matter, heat and temperature, forces, motion, magnets, energy, and sound waves. Credit will not be awarded for students who have credit for PHY 104. 2 Lec/2 Lab.

**CHE 105. Chemistry for the Health Sciences. (3 Credits)**

I, II. Prerequisite: completion of all academic readiness indicators in English and reading or completion of ENG 101R; and math ACT score of 19 or higher, math SAT score of 500 or higher or passing score on the math placement test. or, MAT 105 or higher or STA 215 or higher. Prerequisite or Corequisite: CHE 105L. An introductory course for students in allied health. Principles of bonding structure, and reactivity related to biological processes. A withdrawal from CHE 105 must be matched by a withdrawal from CHE 105L. Gen.Ed. VII (NS) or IVB with CHE 105L.

**CHE 105L. Health Science Chemistry Lab. (1 Credit)**

I, II. Prerequisite: completion of all academic readiness requirements in English and reading or completion of ENG 101R; Math ACT score of 19 or higher, Math SAT score of 510 or higher, MAT105 or higher, or passing score on math placement test, or STA 215 or higher. Prerequisite or Corequisite: CHE 105. Laboratory experiments that demonstrate chemical concepts and laboratory techniques related to the health science profession. 2 Lab. Gen. Ed. VII (NS) or IVB with CHE 105.

**CHE 107. Introductory Chemistry Lab. (1 Credit)**

I, II. Prerequisite: completion of all developmental requirements. Prerequisite or Corequisite: CHE 101 or CHE 105. Laboratory component of CHE 101 and CHE 105. Basic laboratory techniques, methods of separation, types of chemical reactions, solution preparation, titrations, household chemicals, molecular modeling. 2 Lab. Gen. Ed. IVB with CHE 101 or CHE 105.

**CHE 110. General Chemistry Preparation. (3 Credits)**

A. Prerequisite: Completion of all developmental requirements. Prepares students for further studies in general chemistry. Topics will include introduction to matter, chemical formulas and reactions, bonding and molecules, chemical calculations and the periodic table.

**CHE 111. General Chemistry. (3 Credits)**

I, II. Prerequisite or Corequisite: CHE 111L and ACT math score of 22 or higher; or SAT math score of 530; or MAT 112B (C or better) or MAT 114 (C or better) or higher or departmental approval. Principles of atomic and molecular structure and reactivity, stoichiometry, states of matter. Prepares students for further studies in chemistry. One year of high school chemistry is recommended. A withdrawal from CHE 111 must be matched by a withdrawal from CHE 111L. Gen. Ed. VII (NS) or IVB with CHE 111L.

**CHE 111L. General Chemistry Lab I. (1 Credit)**

I, II. Formerly CHE 115. Prerequisite or Corequisite: CHE 111. Laboratory component of CHE 111. Basic laboratory techniques, methods of separation, types of chemical reactions, solution preparation and standardization, titrations, molecular modeling, qualitative analysis, gases, virtual labs on computer. Credit will not be awarded to students who have credit for CHE 115. 3 Lab. Gen. Ed. IVB with CHE 111.

**CHE 112. General Chemistry II. (3 Credits)**

I, II. Prerequisite: CHE 111 and 111L with a grade of "C" or better. Prerequisite or Corequisite: CHE 112L or CHE 112HL with a grade of "C" or better. Continuation of CHE 111. Kinetics and equilibrium, solution chemistry, energy changes in chemical reactions, descriptive inorganic chemistry. Prepares students for further studies in chemistry. A withdrawal from CHE 112 must be matched by a withdrawal from CHE 112L or CHE 112HL. Gen. Ed. VII (NS) or IVB with CHE 112L or CHE 112HL.

**CHE 112L. General Chemistry Lab. (1 Credit)**

I, II. Formerly CHE 116. Prerequisites: CHE 111 and 111L with a grade of "C" or better. Prerequisite or Corequisite: CHE 112 with a grade of "C" or better. Laboratory component of CHE 112. Kinetics, equilibrium, UV-VIS spectroscopy, introductory qualitative and quantitative analysis, electrochemistry, virtual labs on computer. Credit will not be awarded to students who have credit for CHE 116. 3 Lab. Gen. Ed. IVB with CHE 112.

**CHE 200. Volunteering in Chemistry. (0 Credits)**

(0) A. An exposure to chemistry outreach activities, including, but not limited to exploring chemical research projects, organizing chemistry community service, and assisting other chemistry departmental events. Students can choose the focus of the volunteering in each semester. Passing grade achieved for attending 80% of the designated activities in each semester.

**CHE 250. Descriptive Inorganic Chemistry. (2 Credits)**

(2) A. Prerequisite: CHE 112 and CHE 112L with grade of 'C' or better. Basic principles of inorganic chemistry including the discovery of the elements, their properties, and the significance of the Periodic table; atomic structure, bonding models, acid-base chemistry, oxidation-reduction chemistry, and coordination chemistry. (2 Lec)

**CHE 261. Organic Chemistry Preparation. (3 Credits)**

A. Prepares students for further studies in organic chemistry. This course will emphasize fundamental concepts and help students develop a productive mindset for studying Organic Chemistry.

**CHE 325. Analytical Chemistry. (3 Credits)**

A. Prerequisite: CHE 112 and 112L (C or better). Prerequisite or Corequisite: CHE 325L. Introduces chemical analysis (with statistical evaluations) focusing on the principles of stoichiometry, chemical equilibrium, titrimetric and spectrophotometric analysis, potentiometry, and analytical separation processes. 3 Lec. A withdrawal from CHE 325 must be matched by a withdrawal from CHE 325L.

**CHE 325L. Analytical Chemistry Lab. (2 Credits)**

A. Prerequisite: CHE 112 and 112L (C or better). Prerequisite or Corequisite: CHE 325. Lab component of CHE 325. Lab course designed to introduce the principles of wet chemical techniques and basic instrumental analysis through experimentation. 4 Lab.

**CHE 349. Applied Learning in Chemistry. (0.5-8 Credits)**

A. Work in placements related to academic studies. One to eight hours credit per semester or summer. Total hours: sixteen, baccalaureate. A minimum of 80 hours of employment required for each semester hour of academic credit. May not be used to satisfy area, major or minor requirements.

**CHE 349A. Cooperative Study: Chemistry. (0.5-8 Credits)**

A. Work in placements related to academic studies. One to eight hours credit per semester or summer. Total hours: sixteen, baccalaureate. A minimum of 80 hours of employment required for each semester hour of academic credit. May not be used to satisfy area, major or minor requirements.

**CHE 349B. Cooperative Study: Chemistry. (0.5-8 Credits)**

A. Work in placements related to academic studies. May not be used to satisfy area, major or minor requirements.

**CHE 349C. Cooperative Study: Chemistry. (0.5-8 Credits)**

A. Work in placements related to academic studies. May not be used to satisfy area, major or minor requirements.

**CHE 349D. Cooperative Study: Chemistry. (0.5-8 Credits)**

A. Work in placements related to academic studies. May not be used to satisfy area, major or minor requirements.

**CHE 349E. Cooperative Study: Chemistry. (0.5-8 Credits)**

A. Work in placements related to academic studies. May not be used to satisfy area, major or minor requirements.

**CHE 361. Organic Chemistry I. (3 Credits)**

I, II. Prerequisite: CHE 112 and 112L (C or above). Prerequisite or Co-requisite: CHE361L. Bonding; structure; reaction theory; aliphatic hydrocarbons; functional groups; stereochemistry; aromatic hydrocarbons; spectroscopy; substitution and elimination reactions. A withdrawal from CHE 361 must be matched by a withdrawal from CHE 366.

**CHE 361L. Organic Chemistry Lab I. (1 Credit)**

I, II. Formerly: CHE 366. Prerequisite or Corequisite: CHE 361. Laboratory component of CHE 361. Experimental work to illustrate principles of organic chemistry. Basic techniques including separation and spectroscopic methods; and selected syntheses. 3 Lab. Credit will not be awarded to students who have credit for CHE 366.

**CHE 362. Organic Chemistry II. (3 Credits)**

I, II. Prerequisites: CHE 361 and CHE361L ("C" or above). Prerequisite or Co-requisite: CHE362L. Alcohols and ethers; aldehydes and ketones; carboxylic acids and derivatives; carbanions; amines; phenols; carbohydrates and amino acids. A withdrawal from CHE 362 must be matched by a withdrawal from CHE 362L.

**CHE 362L. Organic Chemistry Lab II. (1 Credit)**

I, II. Formerly: CHE 367. Prerequisites: CHE 361 and CHE 361L with a "C" (2.0) or better. Prerequisite or Corequisite: CHE 362. Laboratory component of CHE 362. Experimental work to illustrate principles of organic chemistry. Selected chemical syntheses and advanced techniques such as separation and spectroscopic methods. 3 Lab. Credit will not be awarded to students who have credit for CHE 367.

**CHE 385. Chemical Literature. (3 Credits)**

A. Prerequisites: CHE 112(C) and ENG 102, 105(B), or HON 102. Course introduces chemical literature searching, and methods for disseminating chemical data. At the end of this course students will be able to demonstrate the skill to create effective and appropriate styled chemical reports and presentations. Credit will not be awarded to students who have credit for CHE 385W.

**CHE 385W. Chemical Literature. (3 Credits)**

A. Prerequisites: CHE 112(C) and ENG 102, 105(B), or HON 102. Course introduces chemical literature searching, and methods for disseminating chemical data. At the end of this course students will be able to demonstrate the skill to create effective and appropriate styled chemical reports and presentations. Credit will not be awarded to students who have credit for CHE 385.

**CHE 411. Practicum. (1-3 Credits)**

(1-3) A. Departmental Approval. Students will gain specific experiences through participation in planning, testing, analysis, and/or required maintenance in a designated undergraduate chemistry course. Formal project assigned by faculty mentor. May be retaken for a maximum of three hours. Student must have the Chemistry Practicum Enrollment Form approved by faculty mentor and departmental chair prior to enrollment. 3-9 lab.

**CHE 425. Instrumental Analysis. (3 Credits)**

A. Cross-listed as FOR 411. Prerequisites: CHE 325, 325L, 362, 362L; PHY 132 (or 202); MAT 234 (C or better in each course). Prerequisite or Co-requisite: CHE 425L. Fundamental principles of the operation and application of an analytical instrumentation including spectroscopy, chromatography, electrochemistry, and mass spectrometry found throughout industrial, government, forensic, and/or research environments is presented. Credit will not be awarded to those who have received credit for FOR 411 or CHE 525. 3 Lec.

**CHE 425L. Instrumental Analysis Lab. (1 Credit)**

A. Co-requisite: CHE 425. Lab component of CHE 425. Lab course designed to provide hands-on experience with modern chemical instrumentation for qualitative and quantitative measurements found throughout industrial, government, and/or research environments. Credit will not be awarded for both CHE 425L and FOR 411L. 3 Lab.

**CHE 430. Biochemistry of Macromolecules. (3 Credits)**

A. Prerequisites: CHE 362 and 362L. Structure, analysis, and organization of proteins, nucleic acids, and lipids; physical and organic mechanisms of enzyme action; chemistry of membrane action and the immune system. Credit will not be awarded for both CHE 430 and CHE 530.

**CHE 431. Metabolic Biochemistry. (3 Credits)**

A Prerequisites: CHE 430 (C or better). Continuation of CHE 430. Chemistry, catabolism, and biosynthesis of carbohydrates, lipids, amino acids, and nucleotides; mechanisms of metabolic control.

**CHE 432. Biochemistry Laboratory. (1 Credit)**

A. Prerequisite or Corequisite: CHE 430 or 431 or departmental approval. Experimental techniques characteristic of biochemical research. Purification and characterization of proteins and nucleic acids; use of computers in modeling biochemistry data. 3 Lab. Credit will not be awarded for both CHE 432 and CHE 532.

**CHE 450. Inorganic Chemistry. (3 Credits)**

I. Prerequisite: CHE 250 (C) and CHE 362 (C). Principles of inorganic chemistry with emphasis on advanced chemical bonding models and their applications to solid-state, coordination, organometallic, bioinorganic, and materials chemistry. (3 Lec).

**CHE 485. Chemistry Seminar. (1 Credit)**

I, II. Prerequisite: CHE 362 (C). Presentation of specific chemical research from recent literature and/or performed experimentation to members of the chemistry faculty and departmental majors. One weekly meeting. May be retaken to a maximum of three hours. Cannot be taken concurrent with CHE 385W.

**CHE 495A. Independent Chemical Research. (1 Credit)**

A. Prerequisite: CHE 112 and departmental approval. An introduction to research in all fields of chemistry. Literature-based assigned research project with a faculty mentor that will require a formal research report. May be retaken to a maximum of three hours. A maximum of six hours of independent study may be applied per degree earned. Student must have the independent study proposal form approved by faculty mentor and departmental chair prior to enrollment. Credit will not be awarded for both CHE 495 and CHE 495A. 3 Lab.

**CHE 495B. Chemistry Laboratory Independent Research: \_\_\_\_ (1-3 Credits)**

A. Prerequisites: CHE 112 and departmental approval. Objectives and techniques of chemical research. Problems in all fields of chemistry. May be retaken to a maximum of six hours. A maximum of six hours of independent study may be applied per degree earned. Students must have the independent study proposal form approved by faculty supervisor and departmental chair prior to enrollment. 3-9 Lab. Credit will not be awarded for both CHE 495 and CHE 495B.

**CHE 501. Chemtopics: \_\_\_\_\_. (3 Credits)**

A. Prerequisite: departmental approval. Topics to be chosen from current and/or specialized area of chemistry such as environmental chemistry or industrial chemistry. Topics will vary according to students needs. May be retaken to a maximum of six hours.

**CHE 501A. Chemtopics:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: departmental approval. Topics to be chosen from current and/or specialized area of chemistry based on interests and/or need: A: Analytical, B: Biochemistry, C: Inorganic, D: Organic, or E: Physical. May be retaken to a maximum of six hours.

**CHE 501B. Chemtopics:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: departmental approval. Topics to be chosen from current and/or specialized area of chemistry based on interests and/or need: A: Analytical, B: Biochemistry, C: Inorganic, D: Organic, or E: Physical. May be retaken to a maximum of six hours.

**CHE 501C. Chemtopics:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: departmental approval. Topics to be chosen from current and/or specialized area of chemistry based on interests and/or need: A: Analytical, B: Biochemistry, C: Inorganic, D: Organic, or E: Physical. May be retaken to a maximum of six hours.

**CHE 501D. Chemtopics. (1-3 Credits)**

A. Prerequisite: departmental approval. Topics to be chosen from current and/or specialized area of chemistry based on interests and/or need: A: Analytical, B: Biochemistry, C: Inorganic, D: Organic, or E: Physical. May be retaken to a maximum of six hours.

**CHE 501E. Chemtopics:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: departmental approval. Topics to be chosen from current and/or specialized area of chemistry based on interests and/or need: A: Analytical, B: Biochemistry, C: Inorganic, D: Organic, or E: Physical. May be retaken to a maximum of six hours.

**CHE 501L. Chemtopics Lab:\_\_\_\_. (1 Credit)**

A. Prerequisite: departmental approval. Laboratory experiences chosen from specialized areas of chemistry including advanced chemical instrumentation/analysis, synthetic methods, computational chemistry, or molecular modeling. Topics vary according to student needs. May be retaken to a maximum of two hours. 3 Lab.

**CHE 502. Polymers & Particles. (1 Credit)**

A. Prerequisite: CHE 361/361L ('C' or better in both). Study of the structure, synthesis, preparation, characterization, and properties of synthetic polymers, supramolecular aggregates, and/or meso- or nanoscale materials. (3 Lab)

**CHE 515. Synthetic & Analytical Methods. (3 Credits)**

A. Prerequisites: CHE 362, 362L, 425 (or FOR 411), 425L (or FOR 411L) (C or better in each course). Pre or Corequisite: CHE 450 (C or better). Synthesis, isolation, purification, and characterization (including spectroscopy and other analytical methods) of inorganic and organic compounds and mixtures. Other methods include handling of air and moisture sensitive compounds and molecular computations. 3 Lec/6 Lab.

**CHE 515L. Synthetic & Analytical Methods Lab. (2 Credits)**

A. Prerequisites: CHE 362, 362L, 425 (or FOR 411), 425L (or FOR 411L) (C or better in each course). Senior standing. Prerequisite or Corequisite: CHE 450 (C or better), CHE 515 or CHE 715 (C or better). Synthesis, isolation, purification, and characterization (including spectroscopy and other analytical methods) of inorganic and organic compounds and mixtures. Other methods include handling of air and moisture sensitive compounds and molecular computations. 6 Lab.

**CHE 520. Mass Spectrometry. (3 Credits)**

A. Prerequisite: CHE 362 (C). Topics include types of mass spectrometers; qualitative and quantitative mass spectrometry, different ionization processes, sample inlet systems (including chromatography systems), and interpretation of mass spectral data. Credit will not be awarded for both CHE 520 and FOR 475.

**CHE 570. Biophysical Chemistry I. (4 Credits)**

I, II. Prerequisite: CHE 361 (C or better), BIO 111 or higher (C or better), and either MAT 234 or MAT 261. Prerequisite or Corequisite: PHY 131 or 201. An introduction to physical and chemical explanations of biological phenomenon and physical chemistry theories and methodologies applied on biological systems. Topics include thermodynamics, chemical equilibrium, kinetics, quantum chemistry, spectroscopy, and selected topics. 3 Lec/ 2.5 lab. Credit will not be awarded for CHE 470, 570, 770.

**CHE 574. Physical Chemistry I. (3 Credits)**

A. Prerequisite: CHE 361 (C or better). Prerequisites or Corequisites: CHE 574L and MAT 244 and PHY 131 or 201 (C or better in each course). A study of thermodynamic properties in physical and chemical systems; electrochemical processes; rates and mechanisms of chemical reactions. Credit will not be awarded for both CHE 574 and CHE 471.

**CHE 574L. Physical Chemistry Lab I. (1 Credit)**

A. Prerequisite: CHE 325 and 325L (C or better in each course). Prerequisites or Corequisites: CHE 574 and CHE 385 or 385W (C or better in each course). Laboratory component of CHE 574. Experimental work to illustrate principles of physical chemistry that include thermochemistry, thermodynamics, equilibrium, and reaction kinetics. 3 Lab.

**CHE 575. Physical Chemistry II. (3 Credits)**

A. Prerequisite: CHE 361 (C or better). Prerequisite or Corequisite: CHE 575L and MAT 254 and PHY 132 or 202 (C or better in each course). An introduction to quantum mechanics as applied to model, atomic, and molecular systems; applications of atomic and molecular spectroscopy; introduction to computational chemistry. Credit will not be awarded for both CHE 575 and CHE 472.

**CHE 575L. Physical Chemistry Lab II. (1 Credit)**

A. Prerequisite: CHE 325 and 325L (C or better in each course). Prerequisites or Corequisites: CHE 575 and CHE 385 or 385W (C or better in each course). Laboratory component of CHE 575. Experimental work to illustrate principles of physical chemistry including UV-visible, infrared, and fluorescence spectroscopic techniques, fundamentals of laser operation, statistical mechanics, and computational chemistry. 3 Lab.

**CHE 576. Advanced Physical Chemistry. (3 Credits)**

A. Prerequisite: CHE 575 (MAT 353 Recommended) or departmental approval. Intermediate and advanced topics in thermodynamics, kinetics, structure and bonding. Credit will not be awarded to students who have credit for CHE 572.

## Fermentation

### FMT 140. Introduction to Fermentation. (4 Credits)

A. Prerequisites: completion of all academic readiness requirements. Course will provide an introduction to chemical and biological concepts as it relates to the production of desirable beverages and other products through biochemical pathways of microorganisms typically used (for fermentation process). 3 Lec/ 3 Lab. Gen. Ed. E-4 [NS].

### FMT 343. Fermentation Microbiology. (3 Credits)

A. Prerequisites: FMT 140 (C). Course demonstrates the biochemistry, genetics, and behavior of microorganisms for the production of fermented beverages. 2 Lec/ 3 Lab. Credit will not be awarded for both FMT 343 and 540.

### FMT 344. Chemical Analysis & Quality Control. (4 Credits)

A. Prerequisite: FMT 140 (C) and ACT math score of 22+ or SAT math score of 530+ or MAT 112B (C) or higher. Course focuses on quality assurance and control (QA/QC) based on analysis using chemical and instrumental methods of initial feedstocks, water, and fermentation products. Analysis will be based in current industrial standards. 3Lec/ 3 Lab.

### FMT 345. Sensory Analysis. (2 Credits)

Prerequisite: FMT 140 (C) and age requirement of 21 and over. Basic principles involved in sensory perception pertaining to neurochemistry and practical sensory experience with products generated from fermentation process. 1 LEC/2 LAB.

### FMT 349. Applied Learning in Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349A. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349B. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349C. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349D. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349E. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349F. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349G. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349H. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349I. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

### FMT 349J. Cooperative Study: Fermentation Science. (0.5-8 Credits)

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

**FMT 349K. Cooperative Study: Fermentation Science. (0.5-8 Credits)**

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

**FMT 349L. Cooperative Study: Fermentation Science. (0.5-8 Credits)**

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

**FMT 349M. Cooperative Study: Fermentation Science. (0.5-8 Credits)**

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

**FMT 349N. Cooperative Study: Fermentation Science. (0.5-8 Credits)**

Prerequisite: FMT 140 (C) and departmental approval. Independent investigations and study related to academic studies in fermentation science and based in a laboratory setting. One half to eight hours credit per semester or summer. A minimum of 80 hours of employment required for each semester hour of academic credit. May be repeated for a maximum of 12 credit hours but only three hours may be counted towards the major requirements.

**FMT 495. Fermentation Research. (1-3 Credits)**

A. Prerequisites: FMT 340 (C) and departmental approval. Students concentrate on the objectives and techniques of fermentation science research to address a variety of issues / problems in all aspects of the field. May be retaken to a maximum of six hours but only three hours can count towards a degree. Student must have the independent study proposal form approved by faculty supervisor and departmental chair prior to enrollment. 3-9 Lab.

**FMT 501A. Special Topics in Fermentation:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: Senior standing and departmental approval. Lecture or laboratory experience to be chosen from current and/or specialized area of fermentation science including (but not limited to) historical aspects, advanced methods of analysis, or facility building. Topics will vary according to student interests and needs. May be retaken to a maximum of six hours. If a laboratory course, then three contact hours will be required for every credit hour.

**FMT 501B. Special Topics in Fermentation:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: Senior standing and departmental approval. Lecture or laboratory experience to be chosen from current and/or specialized area of fermentation science including (but not limited to) historical aspects, advanced methods of analysis, or facility building. Topics will vary according to student interests and needs. May be retaken to a maximum of six hours. If a laboratory course, then three contact hours will be required for every credit hour.

**FMT 501C. Special Topics in Fermentation:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: Senior standing and departmental approval. Lecture or laboratory experience to be chosen from current and/or specialized area of fermentation science including (but not limited to) historical aspects, advanced methods of analysis, or facility building. Topics will vary according to student interests and needs. May be retaken to a maximum of six hours. If a laboratory course, then three contact hours will be required for every credit hour.

**FMT 501D. Special Topics in Fermentation:\_\_\_\_. (1-3 Credits)**

A. Prerequisite: Senior standing and departmental approval. Lecture or laboratory experience to be chosen from current and/or specialized area of fermentation science including (but not limited to) historical aspects, advanced methods of analysis, or facility building. Topics will vary according to student interests and needs. May be retaken to a maximum of six hours. If a laboratory course, then three contact hours will be required for every credit hour.

**FMT 549. Fermentation Project Lab. (2 Credits)**

Prerequisites: Senior standing, FMT 343 (C), and 344 (C). Age requirement (>21 years). Course to perform an independent capstone project where students will decide on the process to make a final fermentation product. Complete analysis of the product will also be performed at different stages of production. 1 Lec / 3 Lab.

## Forensic Science

**FOR 301. Introduction to Forensic Science. (3 Credits)**

A. Introduction to the application of scientific methods for the examination of physical evidence in the criminal justice system; an overview of the forensic analysis of firearms, fingerprints, drugs, blood, hair, fibers, paint, glass, arson debris, etc.

**FOR 310. Training for Forensic Internships. (1 Credit)**

(1) A. Prerequisite: Junior or Senior Standing in Forensic Science. This course provides the student guidance in the preparation for an internship and explains the forensic internship application process.

**FOR 330. Bloodstain Pattern Analysis. (1 Credit)**

Prerequisite: FOR 301 (C), BIO 111 (C), and CHE 361(C). Bloodstain Pattern Analysis focuses on the identification and examination of bloodstain patterns, effectively recreating and establishing the types of activities and mechanisms that produced them. Prepares students for further studies/career in forensic biology. (1 Lec/2 Lab). Credit will not be awarded to students who have credit for CHE 501: Bloodstain Pattern Analysis.

**FOR 349. Applied Learning in Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349A. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349B. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349C. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349D. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349E. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349F. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349G. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349H. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349I. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349J. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349K. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349L. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349M. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 349N. Cooperative Study: Forensic Science. (0.5-8 Credits)**

(.5-8) A. Prerequisite: FOR 310 and Departmental Approval. Independent laboratory work and study related to forensic science in a laboratory setting. A minimum of 80 hours of employment are required for each semester hour of academic credit. May be retaken for a maximum of 8 credit hours.

**FOR 401. Forensic Professional Practice. (1 Credit)**

I. Prerequisite or Corequisite: FOR 401. Introduces professional practices and expectation for the forensic scientist. Includes discussion of professional organizations, certification, ethics, QA/QC, accreditation, technical writing, data treatment and interpretation.

**FOR 411. Instrumental Analysis. (3 Credits)**

A. Cross-listed with CHE 425. Prerequisites: CHE 325, 325L, 362, 362L; PHY 132 (or 202); MAT 234 (C or better in each course). Prerequisite or co-requisite: CHE 411L. Fundamental principles of the operation and application of analytical instrumentation including spectroscopy, chromatography, electrochemistry, and mass spectrometry found throughout industrial, government, forensic, and/or research environments is presented. Credit will not be awarded for both FOR 411 and CHE 425.

**FOR 411L. Forensic Instrumental Lab. (1 Credit)**

A. Prerequisite: BIO 121 (C); Prerequisite or co-requisite: FOR 411. Lab component of FOR 411. Hands-on experience operating instrumentation most commonly used in forensic science and analytical laboratories, including spectroscopic and chromatographic techniques. Credit will not be awarded for both FOR 411L and CHE 425L. 3 Lab.

**FOR 412. Forensic Trace Evidence. (3 Credits)**

II. Prerequisites: FOR 411 (C) or CHE 425 (C), FOR 411L (C) or CHE 425L (C), FOR 451 (C), and FOR 451L (C). Prerequisites or Corequisite: FOR 412L. Introduction and the application of the instrumentation and techniques to analyze various types of trace and impression evidence.

**FOR 412L. Forensic Trace Evidence Lab. (1 Credit)**

II. Prerequisites: FOR 411 or CHE 425 (C), FOR 411L or CHE 425L (C), FOR 451 and FOR 451L. Prerequisite or Corequisite: FOR 412. Lab component of FOR 412. Use of microscopes and various instruments for examination of forensic trace evidence materials. 3 Lab.

**FOR 431. DNA Profiling. (3 Credits)**

A. Prerequisite: BIO 111(C). Prerequisite or corequisite: CHE 361(C). This course will include topics in forensic DNA profiling; sample collection, DNA extraction, DNA quantitation and amplification. Prepares students for further studies/ career in forensic/molecular biology. Laboratory FOR 431L is optional with this course. Credit will not be awarded for both FOR 331 and FOR 431.

**FOR 431L. DNA Profiling Lab. (1 Credit)**

A. Prerequisite: CHE 361(C). Prerequisite or co-requisite: FOR 431. Laboratory course of FOR 431. Provides practical experience in Forensic DNA profiling: sample collection, DNA extraction, DNA quantitation and amplification. Prepares students for further studies/career in forensic/molecular biology. Credit will not be awarded for both FOR 331L and FOR 431L.

**FOR 432. Forensic Serology. (1 Credit)**

Prerequisite: FOR 301 (C), BIO 111 (C), CHE 361 (C) and STA 270 or 215. Forensic Serology sample collection, biological fluid identification, and report writing. Prepares students for further studies/career in forensic biology. (1 Lecture/2 Lab).

**FOR 442. Forensic Toxicology & Drugs. (3 Credits)**

(3) II. Formerly: FOR 430. Prerequisite: CHE 362. Study of the chemistry, biochemical activity, isolation and identification of drugs of forensic interest in biological materials. Credit will not be awarded to students who have credit for for FOR 430.

**FOR 442L. Drugs & Toxicology Lab. (1 Credit)**

II. Prerequisites: FOR 411 (C) and 411L (C) or CHE 425 (C) and 425L (C); Prerequisites or Corequisite: FOR 442. Introduces techniques and instrumentation used for the chemical separation and analysis of drugs in both solid dosage and toxicological samples. 3 Lab.

**FOR 451. Forensic Microscopic Analysis. (2 Credits)**

I. Prerequisite or Corequisite: PHY 132 (or 202), MAT 234, and for 451L (C or better). Introduction to concepts of forensic microscopic analysis; identification and characterization of trace evidence, such as glass, hair, fiber, and soil. Only forensic major or minor can take this class.

**FOR 451L. Forensic Microscopy Lab. (1 Credit)**

I. Prerequisite or Corequisite: FOR 451. Laboratory component of FOR 451. Use of stereoscopes and polarizing light microscopes for examination of forensic materials. 3 Lab.

**FOR 460. Selected Topics in Forensic Science. (1-3 Credits)**

A. Prerequisite: instructor approval. Topics will be chosen from areas of current interest and may be retaken for credit when new topics are offered. Topics and credit will be announced prior to each offering.

**FOR 465. Expert Witness Testimony. (3 Credits)**

A. Prerequisites: ENG 102 or ENG 105 (B) or HON 102 and either FOR 331 and 331L(C) or FOR 412 and 412L(C) or FOR 431 and 431L(C) or FOR 442 and 442L(C), INF 322, or departmental approval. Theory and purpose for expert witness testimony, qualifications of scientific experts, ethical issues, and practical aspects of expert witness discovery and courtroom testimony. Videotaping of testifying in mock testifying situations is also included. Credit will not be awarded for both FOR 465W and 465.

**FOR 465W. Expert Witness Testimony. (3 Credits)**

A. Prerequisites: ENG 102 or ENG 105 (B) or HON 102 and either FOR 331 and 331L(C) or FOR 412 and 412L(C) or FOR 431 and 431L(C) or FOR 442 and 442L(C), INF 322, or departmental approval. Theory and purpose for expert witness testimony, qualifications of scientific experts, ethical issues, and practical aspects of expert witness discovery and courtroom testimony. Videotaping of testifying in mock testifying situations is also included. Credit will not be awarded for both FOR 465W and 465.

**FOR 490. Introduction to Research. (1-3 Credits)**

A. Prerequisite: CHE 111(C), 111L(C), BIO 111(C), or departmental approval. Instruction to laboratory research in one of the areas of forensic science. May be retaken to a maximum of six hours, but only three hours may be counted toward the major requirements. Student must have the independent study proposal form approved by faculty supervisor and department chair prior to enrollment. 3-9 Lab.

**FOR 499. Forensic Science Capstone. (3 Credits)**

A. Prerequisites: Either FOR 412 and 412L(C), FOR 431 and 431L(C), or FOR 442 and 442L(C). Prerequisite or Corequisite: FOR 465 or 465W. Capstone experience that provides overview of the investigative process from collection of evidence at a mock crime scene, through analysis, data interpretation, and presentation of results in a mock courtroom setting. 2 Lec/3 Lab.