# COURSE SYLLABUS

<table>
<thead>
<tr>
<th><strong>Course Number:</strong> BCH 4033-L</th>
<th><strong>Course Title:</strong> Biochemistry I Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisite(s):</strong> CHM 2210/2211 with passing grade.</td>
<td></td>
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<tr>
<td><strong>Course Credit:</strong> 1</td>
<td><strong>Course Hours:</strong> 3 per week</td>
</tr>
<tr>
<td><strong>College:</strong> Arts and Sciences</td>
<td><strong>Required Text(s):</strong> None</td>
</tr>
<tr>
<td><strong>Department:</strong> Chemistry</td>
<td>Handouts will be provided</td>
</tr>
<tr>
<td><strong>Faculty Name:</strong> Dr. Ngozi Ugochukwu</td>
<td><strong>Term and Year:</strong> Fall 2010</td>
</tr>
<tr>
<td><strong>Office Location:</strong> 118 FSH (Science Research Building)</td>
<td><strong>Place/Time:</strong> 110 DRS. T11:00-1:50 P.M.</td>
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<tr>
<td></td>
<td><strong>Telephone:</strong> 850-412 7124</td>
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<td><strong>e-mail:</strong> <a href="mailto:ngozi.ugochukwu@famu.edu">ngozi.ugochukwu@famu.edu</a></td>
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</table>

**Office Hours**
- Monday: 1:00-2:00 P.M.
- Tuesday: 10:00-11:00 A.M.; 2:00 – 4:00 P.M.

**Course Description**
Introduction to biochemical techniques. Experiments include pH determination, buffer preparation, organelle separation, protein quantitation, chromatography, and electrophoresis.

**Course Purpose**
Required course for chemistry and biology majors. Introduces students to many biochemical techniques and helps them to understand the principles involved in separation, as well as the advantages and the disadvantages of these techniques.

**References**
6. Campbell, Biochemistry
7. Horton et al, Principles of Biochemistry
The Conceptual Framework in the Professional Education Unit (PEU) at Florida A&M University is an integrated approach to providing educational experiences that result in exemplary professional educators. The Framework is comprised of six themes with the mission of developing high quality classroom teachers, administrators and support personnel. The term “exemplary” refers to the kind of graduates the PEU strives to produce. The figure below provides a diagram of the Exemplary Professional Conceptual Framework:

TECHNOLOGY

• CF 2
  • Through this focal area, the FAMU professional education candidate will:

<table>
<thead>
<tr>
<th>CF: 2.1 (S)</th>
<th>Use of available technology and software to support student learning.</th>
<th>F: 4,12</th>
<th>I: 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 2.7 (S)</td>
<td>Facilitate the use of technology by students.</td>
<td>F: 4,12</td>
<td>I: 6</td>
</tr>
</tbody>
</table>

VALUES

• CF 3
  • Through this focal area, the FAMU professional education candidate will:

<table>
<thead>
<tr>
<th>CF: 3.4(D)</th>
<th>Be committed to individual excellence.</th>
<th>F: 11</th>
<th>I: 5,9</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 3.5(D)</td>
<td>Recognize the importance of peer Relationships in establishing a climate for learning.</td>
<td>F: 2, 7</td>
<td>I: 5,10</td>
</tr>
</tbody>
</table>

CRITICAL THINKING

• CF 4
  • Through this focal area, the FAMU professional education candidate will:

<table>
<thead>
<tr>
<th>CF: 4.2 (S)</th>
<th>Use a variety of instructional/professional strategies to encourage students’ development of critical thinking and performance.</th>
<th>F: 2, 7</th>
<th>I: 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 4.3 (D)</td>
<td>Value critical thinking and self-directed learning as habits of mind.</td>
<td>F: 4</td>
<td>I: 1,4</td>
</tr>
<tr>
<td>CF: 4.5 (S)</td>
<td>Demonstrate the use of higher order thinking skills.</td>
<td>F: 8</td>
<td>I: 4</td>
</tr>
</tbody>
</table>

PROFESSIONALISM
- CF 5
- Through this focal area, the FAMU professional education candidate will:

<table>
<thead>
<tr>
<th>CF: 5.1 (K)</th>
<th>Know the content</th>
<th>F: 8</th>
<th>I: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 5.6 (S)</td>
<td>Display effective verbal &amp; non-verbal communication techniques to foster valuable interaction in the classroom.</td>
<td>F: 2</td>
<td>I: 6</td>
</tr>
<tr>
<td>CF: 5.7 (S,D)</td>
<td>Display appropriate code of conduct including dress, language, and respective behavior.</td>
<td>F: 11</td>
<td>I: 5, 9</td>
</tr>
</tbody>
</table>

**National and State Standards Addressed in the Course**

**Interstate New Teacher Assessment and Support Consortium (INTASC) Standards**

**Standard 1: Subject Matter:** The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

1.10 **Knowledge**
1.12 The teacher understands how students' conceptual frameworks and their misconceptions for an area of knowledge can influence their learning.

1.13 The teacher can relate his/her disciplinary knowledge to other subject areas.

1.20 **Dispositions**
1.24 The teacher is committed to continuous learning and engages in professional discourse about subject matter knowledge and children's learning of the discipline.

1.30 **Performances**
1.35 The teacher develops and uses curricula that encourage students to see, question, and interpret ideas from diverse perspectives.

**Standard 4: Instructional Strategies:** The teacher understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

4.10 **Knowledge**
4.11 The teacher understands the cognitive processes associated with various kinds of learning (e.g. critical and creative thinking, problem structuring and problem solving, invention, memorization and recall) and how these processes can be stimulated.

4.12 The teacher understands the principles and techniques, along with advantages and limitations, associated with various instructional strategies (e.g. cooperative learning, direct instruction, discovery learning, whole group discussion, independent study, interdisciplinary instruction).

4.13 The teacher knows how to enhance learning through the use of a wide variety of materials as well as human and technological resources (e.g. computers, audio-visual technologies, videotapes and discs, local experts, primary documents and artifacts, texts, reference books, literature, and other print resources).

4.20 **Dispositions**
4.21 The teacher values the development of students' critical thinking, independent problem solving, and performance capabilities.

4.23 The teacher values the use of educational technology in the teaching and learning process.
4.30 Performances
The teacher carefully evaluates how to achieve learning goals, choosing alternative teaching strategies and materials to achieve different instructional purposes and to meet student needs (e.g. developmental stages, prior knowledge, learning styles, and interests).

4.33 The teacher constantly monitors and adjusts strategies in response to learner feedback.

4.34 The teacher varies his or her role in the instructional process (e.g. instructor, facilitator, coach, audience) in relation to the content and purposes of instruction and the needs of students.

4.36 The teacher uses educational technology to broaden student knowledge about technology, to deliver instruction to students at different levels and paces, and for advanced levels of learning.

Standard 5, Learning Environment
The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.

5.10 Knowledge
5.11 The teacher can use knowledge about human motivation and behavior drawn from the foundational sciences of psychology, anthropology, and sociology to develop strategies for organizing and supporting individual and group work.

5.12 The teacher understands how social groups function and influence people, and how people influence groups.

5.13 The teacher knows how to help people work productively and cooperatively with each other in complex social settings.

5.14 The teacher understands the principles of effective classroom management and can use a range of strategies to promote positive relationships, cooperation, and purposeful learning in the classroom.

5.15 The teacher recognizes factors and situations that are likely to promote or diminish intrinsic motivation, and knows how to help students become self-motivated.

5.20 Dispositions
5.21 The teacher takes responsibility for establishing a positive climate in the classroom and participates in maintaining such a climate in the school as a whole.

5.22 The teacher understands how participation supports commitment, and is committed to the expression and use of democratic values in the classroom.

5.23 The teacher values the role of students in promoting each other’s learning and recognizes the importance of peer relationships in establishing a climate of learning.

5.24 The teacher recognizes the values of intrinsic motivation to students' life-long growth and learning.

5.25 The teacher is committed to the continuous development of individual students' abilities and considers how different motivational strategies are likely to encourage this development for each student.

5.30 Performances
5.31 The teacher creates a smoothly functioning learning community in which students assume responsibility for themselves and one another, participate in decision making, work collaboratively and independently, and engage in purposeful learning activities.

5.32 The teacher engages students in individual and group learning activities that help them develop the motivation to achieve, by, for example, relating lessons to students' personal interests, allowing students to have choices in their
learning, and leading students to ask questions and pursue problems that are meaningful to them.

5.33 The teacher organizes, allocates, and manages the resources of time, space, activities, and attention to provide active and equitable engagement of students in productive tasks.

5.34 The teacher maximizes the amount of class time spent in learning by creating expectations and processes for communication and behavior along with a physical setting conducive to classroom goals.

5.35 The teacher helps the group to develop shared values and expectations for student interactions, academic discussions, and individual and group responsibility that create a positive classroom climate of openness, mutual respect, support, and inquiry.

5.36 The teacher analyzes the classroom environment and makes decisions and adjustments to enhance social relationships, student motivation and engagement, and productive work.

5.37 The teacher organizes, prepares students for, and monitors independent and group work that allows for full and varied participation of all individuals.

Standard 6, Communication
The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.

6.10 Knowledge
6.11 The teacher understands communication theory, language development, and the role of language in learning.

6.12 The teacher understands how cultural and gender differences can affect communication in the classroom.

6.13 The teacher recognizes the importance of nonverbal as well as verbal communication.

6.14 The teacher knows about and can use effective verbal, nonverbal, and media communication techniques.

6.20 Dispositions
6.21 The teacher recognizes the power of language for fostering self-expression, identity development, and learning.

6.22 The teacher values many ways in which people seek to communicate and encourages many modes of communication in the classroom.

6.23 The teacher is a thoughtful and responsive listener.

6.24 The teacher appreciates the cultural dimensions of communication, responds appropriately, and seeks to foster culturally sensitive communication by and among all students in the class.

6.30 Performance
6.31 The teacher models effective communications strategies in conveying ideas and information and in asking questions (e.g. monitoring the effects of messages, restating ideas and drawing connections, using visual, aural, and kinesthetic cues, being sensitive to nonverbal cues given and received).

6.32 The teacher supports and expands learner expression in speaking, writing, and other media.

6.33 The teacher knows how to ask questions and stimulate discussion in different ways for particular purposes, for example, probing for learner understanding, helping students articulate their ideas and thinking processes, promoting risk-taking and problem-solving, facilitating factual recall, encouraging convergent and divergent thinking, stimulating curiosity, helping stimulate students to question.

6.34 The teacher communicates in ways that demonstrate a sensitivity to cultural and gender differences (e.g. appropriate
use of eye contact, interpretation of body language and verbal statements, acknowledgment of and responsiveness to different modes of communication and participation).

6.35 The teacher knows how to use a variety of media communication tools, including audio-visual aids and computers, including educational technology, to enrich learning opportunities.

Standard 9: Reflection and Professional Development: The teacher is a reflective practitioner who continually evaluates the effects of her/his choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally

9.10 Knowledge
9.11 The teacher understands the historical and philosophical foundations of education.

9.12 The teacher understands methods of inquiry that provide him/her with a variety of self-assessment and problem solving strategies for reflecting on his/her practice, its influences on students' growth and learning, and the complex interactions between them.

9.13 The teacher is aware of major areas of research on teaching and of resources available for professional learning (e.g. professional literature, colleagues, professional associations, professional development activities).

9.20 Dispositions
9.21 The teacher values critical thinking and self-directed learning as habits of mind.

9.22 The teacher is committed to reflection, assessment, and learning as an ongoing process.

9.23 The teacher is willing to give and receive help.

9.24 The teacher is committed to seeking out, developing, and continually refining practices that address the individual needs of students.

9.25 The teacher recognizes her/his professional responsibility for engaging in and supporting appropriate professional practices for self and colleagues.

9.30 Performance
9.31 The teacher uses classroom observation, information about students, and research as sources for evaluating the outcomes of teaching and learning and as a basis for experimenting with, reflecting on, and revising practice.

9.32 The teacher seeks out professional literature, colleagues, and other resources to support her/his own development as a learner and a teacher.

9.33 The teacher draws upon professional colleagues within the school and other professional arenas as supports for reflection, problem-solving and new ideas, actively sharing experiences and seeking and giving feedback.

Standard 10: Collaboration, Ethics, and Relationships: The teacher communicates and interacts with parents/guardians, families, school colleagues, and the community to support students' learning and well-being.

10.10 Knowledge
10.11 The teacher understands schools as organizations within the larger community context and understands the operations of the relevant aspects of the system(s) within s/he works.
10.12 The teacher understands how factors in the students' environment outside of school (e.g. family circumstances, community environments, health and economic conditions) may influence students' life and learning.

10.13 The teacher understands and implements laws related to student's rights and teacher responsibilities (e.g. for equal education, appropriate education for students with disabilities, confidentiality, privacy, appropriate treatment of students, reporting in situations related to possible child abuse).
\textbf{10.20 Dispositions}

10.21 The teacher values and appreciates the importance of all aspects of a child's experience.

10.22 The teacher is concerned about all aspects of child's well-being (cognitive, emotional, social, and physical), and is alert to signs of difficulties.

10.23 The teacher respects the privacy of students and confidentiality of information.

10.24 The teacher is willing to consult with other adults regarding the education and well-being of her/his students.

10.25 The teacher is willing to work with other professionals to improve the overall learning environment for students.

\textbf{10.30 Performances}

10.31 The teacher participates in collegial activities designed to make the entire school a productive learning environment.

10.32 The teacher makes links with the learners' other environments on behalf of students, by consulting with parents, counselors, teachers of other classes and activities within the schools, and professionals in other community agencies.

10.33 The teacher can identify and use community resources to foster student learning.

10.34 The teacher establishes respectful and productive relationships with parents and guardians from diverse home and community situations, and seeks to develop cooperative partnerships in support of student learning and well being.

10.35 The teacher talks with and listens to the student, is sensitive and responsive to clues of distress, investigates situations, and seeks outside help as needed and appropriate to remedy problems.

10.36 The teacher acts as an advocate for students.

\textbf{Florida Educator Accomplished Practices (FEAP)}

\textbf{Accomplished Practice #2: COMMUNICATION}

2.1 The preprofessional teacher recognizes the need for effective communication in the classroom and is in the process of acquiring techniques which she/he will use in the classroom.

2.2 STANDARD: Communication -- Uses effective communication techniques with students and all other stakeholders.

2.a Establishes positive interactions in the learning environment that uses incentives and consequences for students.

2.b Establishes positive interactions between the teacher and student that are focused upon learning.

2.c Varies communication (both verbal and nonverbal) according to the nature and needs of individuals.

2.d Encourages students in a positive and supportive manner.

2.e Communicates to all students high expectations for learning.

2.h Practices strategies that support individual and group inquiry.

2.j Identifies communication techniques for use with colleagues, school/community specialists, administrators, and families, including families whose home language is not English.

\textbf{Accomplished Practice #4: Critical-thinking}

4.1 The pre-professional teacher is acquiring performance assessment techniques and strategies that measure higher order thinking skills in students and is building a repertoire of realistic projects and problem-solving activities designed to assist all students in demonstrating their ability to think creatively. (A) Uses appropriate techniques and strategies which promote and enhance critical, creative, and evaluative thinking capabilities of students.

1. Uses assessment strategies (traditional and alternate) to assist the continuous development of the learner.

\textbf{ASSESSMENT}

4.2. Uses appropriate techniques and strategies which promote and enhance critical, creative, and evaluative thinking capabilities of students.

4.a Provides opportunities for students to learn higher-order thinking skills.

4.b Identifies strategies, materials, and technologies that she/he will use to expand students’ thinking abilities.
4.g Demonstrates and models the use of higher-order thinking abilities.

Accomplished Practice #7: HUMAN DEVELOPMENT AND LEARNING
7.1 Drawing upon well established human development/learning theories and concepts and a variety of information about students, the preprofessional teacher plans instructional activities.
7.a Recognizes developmental levels of students and identifies differences within a group of students.
7.d Communicates with students effectively by taking into account their developmental levels, linguistic development, cultural heritage, experiential background, and interests.
7.e Varies activities to accommodate different student learning needs, developmental levels, experiential backgrounds, linguistic development, and cultural heritage.
7.h Develops short-term personal and professional goals relating to human development and learning.

Accomplished Practice #8: KNOWLEDGE OF SUBJECT MATTER
8.2 Demonstrates knowledge and understanding of the subject matter.
8.b Increases subject matter knowledge in order to integrate the learning activities.
8.f Develops short- and long-term personal and professional goals relating to knowledge of subject matter.

Accomplished Practice #11: ROLE OF THE TEACHER
11.1 The preprofessional teacher communicates and works cooperatively with families and colleagues to improve the educational experiences at the school.
11.2 STANDARD: Role of the Teacher -- Works with various education professionals, parents, and other stakeholders in the continuous improvement of the educational experiences of students.
11.b Provides meaningful feedback on student progress to students and families and seeks assistance for self and families.

Accomplished Practice #12: TECHNOLOGY
12.b Uses technology tools on a personal basis.
12.c Demonstrates awareness of and models acceptable use policies and copyright issues.
12.d Identifies and uses standard references in electronic media.
12.i Selects and utilizes educational software tools for instructional purposes based upon reviews and recommendations of other professionals.
12.j Uses digital information obtained through intranets and/or the Internet (e.g., e-mail and research).
12.k Uses technology to collaborate with others.
12.l Develops professional goals relating to technology integration.

National Science Teachers Association Standards (NSTA)

Standard 1: Content

Teachers of science understand and can articulate the knowledge and practices of contemporary science. They can interrelate and interpret important concepts, ideas, and applications in their fields of licensure; and can conduct scientific investigations. To show that they are prepared in content, teachers of science must demonstrate that they:

a. Understand and can successfully convey to students the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.
b. Understand and can successfully convey to students the unifying concepts of science delineated by the National Science Education Standards.
c. Understand and can successfully convey to students important personal and technological applications of science in their fields of licensure.
d. Understand research and can successfully design, conduct, report and evaluate investigations in science.
e. Understand and can successfully use mathematics to process and report data, and solve problems, in their field(s) of licensure.

A.5. To create interdisciplinary perspectives and to help students understand why science is
important to them, elementary generalists should be prepared to lead students to understand:

29. How to use observation, experimentation, data collection, and inference to test ideas and construct concepts scientifically.

B.4. To create interdisciplinary perspectives and to help students understand why science is important to them, elementary/middle level science specialists should have all of the competencies described for the elementary generalist, but also should be prepared to lead students to understand:

33. Use of technological tools in science, including calculators and computers.

C.3.a. **Core Competencies.** All teachers of chemistry should be prepared lead students to understand the unifying concepts required of all teachers of science, and should in addition be prepared to lead students to understand:

1. Fundamental structures of atoms and molecules.

C.3.b. **Advanced Competencies.** In addition to the core competencies, teachers of chemistry as a primary field should also be prepared to effectively lead students to understand:

19. Major biological compounds and natural products.
26. How to design, conduct, and report research in chemistry. (CHM 4930)

**Standard 10: Professional Growth**

Teachers of science strive continuously to grow and change, personally and professionally, to meet the diverse needs of their students, school, community, and profession. They have a desire and disposition for growth and betterment. To show their disposition for growth, teachers of science must demonstrate that they:

a. Engage actively and continuously in opportunities for professional learning and leadership that reach beyond minimum job requirements.

b. Reflect constantly upon their teaching and identify ways and means through which they may grow professionally.

c. Use information from students, supervisors, colleagues and others to improve their teaching and facilitate their professional growth.

**Professional Organization/Learned Society Standards**

National Society of Science Teachers Association
Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE) Competencies and Skills

**Professional Society / National and State Standards Addressed in the Course**

**American Chemical Society (ACS) Expected Outcomes:**

This course should ensure that students know basic chemical concepts such as stoichiometry, states of matter, atomic structure, molecular structure and bonding, thermodynamics, equilibria, and kinetics. Students need to be competent in basic laboratory skills such as safe practices, keeping a notebook, use of electronic balances and volumetric glassware, preparation of solutions, chemical measurements using pH electrodes and spectrophotometers, data analysis, and report writing.

**Course Artifacts**

<table>
<thead>
<tr>
<th>Standards</th>
<th>Name of the Artifact 1</th>
<th>Name of the Artifact 2</th>
<th>Name of the Artifact 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEU CF</td>
<td>Determination of pH</td>
<td>Buffer calculations</td>
<td>Interpret graphical data</td>
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</table>
Rubric for evaluation (for all artifacts):

4 points - Calculation, reasoning, graphs when plotted and results are correct.
3 points - Calculations, graphs when plotted and reasoning are correct.
2 points - Calculations and graphs when plotted are correct.
1 point - Calculations are partly correct.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Behavioral Objectives</th>
<th>INTASC Standards</th>
<th>FTCE SAE</th>
<th>FEAPS Standards</th>
<th>NSTA Standards</th>
<th>PEU Conceptual Framework</th>
</tr>
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<tbody>
<tr>
<td>Laboratory Report: Each laboratory report will address the design and conduct of research, and analysis and organization of data from research experiments</td>
<td>Students will 1. Demonstrate knowledge of the lecture material, and 2. Develop and enhance the skill of analytical analysis and problem solving</td>
<td>1, 4, 5, 6, 9, 10</td>
<td>1.8, 3.1, 3.16, 4.8, 4.14, 4.20, 6.3, 6.4, 6.5, 6.6, 7.2, 7.3, 7.4, 7.5</td>
<td>2, 4, 7, 8, 11, 12</td>
<td>1; 1.A.5.29; 1.B.4.33; 1.C.3.a.1, 3, 9; 1.C.3.b.19, 26; 10.a, 10.b, 10.c.</td>
<td>1.5, 2.1, 3.4, 3.5, 4.3, 4.5, 5.1, 5.7</td>
</tr>
<tr>
<td>Quizzes: Student is to read a paper from a journal and write a critique.</td>
<td>This activity addresses the critical thinking capability and communication skills of the student.</td>
<td>1, 4, 5, 6, 9, 10</td>
<td>1.8, 3.1, 3.16, 4.8, 4.14, 4.20, 6.3, 6.4, 6.5, 6.6, 7.2, 7.3, 7.4, 7.5</td>
<td>2, 4, 7, 8, 11, 12</td>
<td>1; 1.A.5.29; 1.B.4.33; 1.C.3.a.1, 3, 9; 1.C.3.b.19, 26; 10.a, 10.b, 10.c.</td>
<td>1.5, 2.1, 3.4, 3.5, 4.3, 4.5, 5.1, 5.7</td>
</tr>
<tr>
<td>Exams: One mid-term test covering labs done in the first half of the semester. Final exam is comprehensive and will cover the materials covered in the labs for the entire semester.</td>
<td>Develop critical thinking and written communication skills</td>
<td>1, 4, 5, 6, 9, 10</td>
<td>1.8, 3.1, 3.16, 4.8, 4.14, 4.20, 6.3, 6.4, 6.5, 6.6, 7.2, 7.3, 7.4, 7.5</td>
<td>2, 4, 7, 8, 11, 12</td>
<td>1; 1.A.5.29; 1.B.4.33; 1.C.3.a.1, 3, 9; 1.C.3.b.19, 26; 10.a, 10.b, 10.c.</td>
<td>1.5, 2.1, 3.4, 3.5, 4.3, 4.5, 5.1, 5.7</td>
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Overall Goals of the Course

Students are expected to learn basic biochemical principles and techniques involving pH measurement, preparation of
buffers, isolation and analysis of proteins, enzyme kinetics and electrophoresis. Train the students to keep an accurate record of the results and display an understanding of the subject through explanations of the results.

**Specific Behavioral Objectives**

**Learning objectives by Experiments**

**Experiment 1: Laboratory safety.** (FTCE 8.1, 8.2, 8.3, 8.4, 8.5; ACS)
1. Learn safety precautions to be followed in the laboratory.
2. Know the location of safety equipment and procedures to be followed in case of accidents.

**Experiment 2: Calculation of pH, pOH and pKa.** (FTCE 4.20, 7.5; ACS)
1. Understand the definition and measurement of pH.
2. Calculate pH and pOH when the concentration $[H^+]$ and $[OH^-]$ are given and *vice versa*.
3. Calculate $Ka'$ from $pKa'$ and *vice versa*.

**Experiment 3: Preparation of buffers.** (FTCE 4.14, 7.2, 7.3, 7.5; ACS)
1. Learn to use Henderson-Hasselbalch equation to determine the amounts of chemicals needed to be mixed in order to make a buffer of a specific pH.
2. Convert moles to grams.
3. Learn to use a pH meter.
4. Measure volume accurately.

**Experiment 4: Differential Centrifugation** (FTCE 1.8; ACS)
1. Understand the relationship between density and rate of movement of organelles.
2. Distinguish between density and mass.
3. Separate organelles on the basis of density.
5. Color reactions resulting in specific staining of organelles.

**Experiment 5: Size exclusion chromatography.** (FTCE 1.8, 6.9; ACS)
1. Define mobile phase, stationary phase beads, and void volume.
2. Understand Stoke’s radius and size of molecules.

**Experiment 6: Spectrophotometry.** (FTCE 4.15, 6.3, 8.1, 8.2, 8.3; ACS)
1. Distinguish absorbance and transmittance.
2. Use absorbance to determine concentration of macromolecules.
3. Determine numerical values from graph.
4. Understand the terminology ‘Molar extinction coefficient’.

**Experiment 7: Electrophoresis and Molecular weight determination.** (FTCE 1.8, 3.16; ACS)
1. Understand the relationship between size of macromolecule, mobility and Rf value.
2. Determine the molecular weight of a protein graphically.

**Experiment 8: Enzyme kinetics: Effect of $[E]$, and $[S]$ on rate of reaction.** (FTCE 4.8, 6.3, 6.4, 6.5, 6.6, 7.4, 7.5; ACS)
1. Understand ‘bias’ and how to avoid it.
2. Learn to determine Km and Vmax graphically.

**Experiment 9: Enzyme Kinetics: Effect of inhibition.** (FTCE 6.5, 6.6, 7.4; ACS)
1. Learn to analyze results and determine the type of inhibition.

**Experiment 10: Western Blot** (FTCE 3.16, 6.12; ACS)
2. Learn about the different membranes that can be used.
American Chemical Society (ACS) Expected Outcomes:
This course should ensure that students know basic chemical concepts such as stoichiometry, states of matter, atomic structure, molecular structure and bonding, thermodynamics, equilibria, and kinetics. Students need to be competent in basic laboratory skills such as safe practices, keeping a notebook, use of electronic balances and volumetric glassware, preparation of solutions, chemical measurements using pH electrodes and spectrophotometers, data analysis, and report writing.

Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE) Competencies and Skills
1. Knowledge of the nature of matter.
   8. Differentiate chemical methods for separating the components of mixtures.

   1. Identify the basic theory and applications of spectroscopy.
   16. Differentiate between the structures of common biochemical compounds, such as lipids, amino acids, carbohydrates and nucleic acids.

4. Knowledge of chemical reactions and stoichiometry.
   8. Analyze the effects of concentration, temperature, pressure, surface area, and the presence or absence of catalysts on the rates of reaction.
   14. Evaluate the properties of buffer systems.
   20. Solve problems related to pH of strong acids or bases.

5. Knowledge of atomic theory and structure.
   5. Relate chemical activity to electron configuration.

6. Knowledge of the nature of science.
   3. Identify the variables in a given experimental design.
   4. Identify bias in an experimental design.
   5. Evaluate, interpret, and predict from empirical data
   6. Interpret graphical data.
   9. Differentiate between the uses of qualitative and quantitative data.
   12. Identify evidence of the progressive development of science.

7. Knowledge of measurement.
   1. Convert between dimensional units for 1,2, and 3 dimensional measurements.
   2. Analyze the dimensional units of a mathematical formula.
   3. Identify prefixes used in scientific measurements.

   4. Distinguish between accuracy and precision and between systematic and random error.
   5. Apply the correct number of significant figures in measurements or calculations.

8. Knowledge of appropriate laboratory use and procedures
   1. Identify appropriate chemistry laboratory procedures for the safe storage, use and disposal of materials and equipment.
   2. Choose the correct laboratory equipment for a particular procedure.
   3. Identify emergency procedures and safety equipment needed in the science laboratory
   4. and classroom.
   5. Identify the areas of teacher liability and responsibility in science-related activities.
6. Demonstrate knowledge of pertinent legislation and national guidelines regarding laboratory safety, hazardous materials, experimentation, and accommodations for special needs students (e.g. American Chemical Society, National Science Teachers Association).

**Academic Learning Compact (ALC) / Expected Outcomes**

The ALC is located at the home page of the University under ‘Academics’. Upon completion of the course the student should be able to demonstrate the following:

1. **Communication:**
   - Effectively communicate biochemical concepts and principles both orally and in writing.

2. **Content:**
   - Exhibit knowledge of biochemical principles and other biochemical information gained through the aforementioned ‘Learning objectives’.

3. **Critical Thinking:**
   - Analyze and solve biochemical problems; read, evaluate and interpret numerical data and other biochemical information.

4. **Information Resources:**
   - Demonstrate effective use of information resources and technology in biochemical applications.

5. **Laboratory Skills:**
   - Identify appropriate laboratory data collection procedures and equipment necessary to perform standard laboratory activities, interpret data, identify standard safety procedures, hazardous chemicals and chemical reactions.

**Topical Outline**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory safety</td>
<td>1</td>
</tr>
<tr>
<td>Calculation of pH, pOH and pKa</td>
<td>2</td>
</tr>
<tr>
<td>Preparation of buffers</td>
<td>3</td>
</tr>
<tr>
<td>Differential Centrifugation</td>
<td>4</td>
</tr>
<tr>
<td>Size exclusion chromatography</td>
<td>5</td>
</tr>
<tr>
<td>Spectrophotometry</td>
<td>6</td>
</tr>
<tr>
<td>Electrophoresis and Molecular weight determination</td>
<td>7</td>
</tr>
<tr>
<td>Enzyme kinetics: Effect of [E], and [S] on rate of reaction</td>
<td>8</td>
</tr>
<tr>
<td>Enzyme Kinetics: Effect of inhibition</td>
<td>9</td>
</tr>
<tr>
<td>Western Blot</td>
<td>10</td>
</tr>
</tbody>
</table>

**Teaching Methodology**

Lecture Style

**Course Calendar**

<table>
<thead>
<tr>
<th>Week of:</th>
<th>August 31</th>
<th>Introduction, Lab safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>7</td>
<td>Calculations: pH, pOH and pKa</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Buffers</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Protein Purification</td>
</tr>
</tbody>
</table>
Course Evaluation
Written quizzes, Laboratory reports and Exams.

Grading
Each lab report will be worth 20 points.
A quiz, worth 5 points, will be given at the beginning of each lab.
Any discrepancy in evaluation should be taken up within one week of receiving the corrected material.

The final grade for this class will be based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab reports and Quizzes</td>
<td>250</td>
</tr>
<tr>
<td>Mid-term Test</td>
<td>50</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>350</td>
</tr>
</tbody>
</table>

Based on the percentage of points obtained by the student the grade will be assigned as follows:

- **A** 90% and above
- **B** 80% - < 90%
- **C** 70% - < 80%
- **D** 60% - < 70%
- **F** < 60%

Course Policies

General Guidelines
It is expected that the student will follow the guidelines listed below:

1. Read the lab handout and come prepared for the lab. Be on time for the lab.
2. Do not eat or drink in the laboratory. Must wear lab coat and closed toe shoes.
3. Report chemical spills and breakages to the instructor who will advise you on how to clean them up safely.
4. Most of the chemicals, glassware and equipment that will be used in the laboratory are expensive and therefore should be handled with care to avoid waste, damage or breakage.
5. The laboratory work involves carrying out experimental protocols, making careful observations and recording them. These activities demand a quiet environment and mental concentration. Students should therefore avoid participating in conversations, distracting discussions, loud laughter and such while you are in the laboratory.
6. There is an emergency shower and an eyewash station in the laboratory. Familiarize yourself with their location and their operation.
7. If an experiment is conducted as a group effort each student in a group should carry out his/her fair share of the experiment. Once the data is obtained the calculations and answering of questions should be an individual effort.
8. Finish the experiment on time. Upon completion of the experiment all the materials used in the lab are to be cleaned and put away as directed by the instructor.
9. A lab report should be turned in on the day and time indicated by the Instructor.
Lab Reports & Notebook

Lab reports should be hand written in approved composition notebooks.
The report should consist of the following:
Title Page (title, your name, lab partner names, date of experiment, your signature)
Purpose
Procedure
Calculations/Data/Observations/Results
Conclusions
Discussion (chemical theory, results, significance)

Late reports will not be corrected.

Attendance:
Attendance at each lab session will be recorded. There are no make-up labs. If a student will be missing a lab he/she should discuss it with the Instructor beforehand or as soon as he/she returns to school. In case of an absence the student should produce an official excuse from the Dean, College of Arts and Science, within one week of returning to class. Otherwise the student will earn zero points for the lab. As per the University catalog, only one unexcused absence is allowed for this course. Subsequent absences will result in a grade of ‘F’ in the course. It is the responsibility of the student to keep track of the dates of absences and to submit the official excuses on time.

Academic Honor:
Each student is expected to be honest and truthful in carrying out his/her responsibilities in the course. It is your responsibility to know the University’s policy on academic/intellectual dishonesty (Section 6C3-2.012(10)(s) of the FAMU Student Handbook. Any student caught cheating in any manner will receive the grade of F. No warnings will be given. All persons collaborating in cheating will receive the grade of ‘F’.

Students with Disabilities:
Individuals who need a reasonable accommodation must notify the Office of Equal Opportunity Program at 599-3076. During the first week of class, provide your instructor with a statement from the FAMU student disability resource center indicating that you have registered with FAMU student disability services. The statement should indicate the disability and the special accommodation that will be required.

Non-discrimination:
It is the policy of the University to assure that each student is permitted to attend class in an environment free from any form of discrimination, including race, religion, color, age, handicap, sex, marital status, national origin and veteran status.

Procedure for resolving faculty/student conflicts
- Student first attempts to resolve issue with instructor.
- Student submits written statement of problem to the Chairman of the Chemistry department.
- Chairman forwards student’s statement to instructor.
- Instructor responds in writing to the Chairman.
- Chairman meets with instructor and/ or student, if necessary.
- Chairman forwards response/recommendation to the Dean’s office.