Biochemistry I – CHEM 4401  
Department of Physical and Environmental Sciences  
Summer II 2019

A.  Course information

Course number/section: CHEM 4401.001  
Class meeting time: MTWR 10:00 – 11:55 a.m.  
Class location: CS-115  
Course Website: https://bb9.tamucc.edu/

B.  Instructor information

Instructor: Dr. Narendra Narayana  
Office location: Center for Science 130D  
Office hours: T/W/R 8 a.m. – 10 a.m. or by appointment  
Telephone: 825-3644  
e-mail: nnarayana1@tamucc.edu  
Appointments: please send email

C.  Course description

Catalog Course Description

4 sem. hrs. (3:3) The structure and function of carbohydrates, lipids, proteins, and nucleic acids. An introduction to enzyme kinetics, cell membrane structure and biochemical signaling. Laboratory exercises demonstrate the basic principles and techniques used in Biochemistry. This course is typically offered in the fall, spring and summer. Prerequisites: CHEM 3412 and one year of Biology. NOTE: All students registering for this course must also register for SMTE 0093 which is an online Chemistry Lab Safety course that must be completed before the end of the second week of the semester in order to be able to continue attending the lab sections of the course. Also note that since lecture and lab are linked you cannot drop the lab without dropping the lecture as well.

Extended Course Description

CHEM 4401 is the first part of a two-semester biochemistry course that covers the composition, structure, and function of bio-molecules (carbohydrates, lipids, nucleic acids and proteins) and the enzyme kinetics. This course has a laboratory component that covers basic biochemical techniques – preparation of buffer solutions, enzyme kinetics, protein quantification, analysis of sugar content, and DNA extraction. Students shall have experience in the analysis and presentation of biochemical data.

Course objectives: In this course students will learn:
To identify important biochemical functional groups, the types of molecular interactions (hydrogen, ionic, hydrophobic, etc.), and their role in biochemical structure and activity.

To recognize and describe the chemical and physical properties of the universal solvent “water”, its relationship to ionization constants, the pH of a solution, and its role in the structure and function of proteins, nucleic acids, carbohydrates and lipids.

To identify the building blocks of biopolymers (proteins, polysaccharides, nucleotides, and lipids), compare and contrast their chemical characteristics and biological roles.

About the primary features of protein structure and function, including 3-dimensional architecture and folding, ligand binding, and enzyme catalysis and its regulation.

About the primary features of polysaccharide structure and function, and describe their major biological roles.

About the nucleic acid (DNA, RNA) structure, chemistry, and applications in biology.

To describe the construction and function of biological membranes.

To identify and describe the basic mechanisms of biological signal transduction.

To perform basic biochemistry procedures including buffer preparation, spectrophotometry, chromatography, enzyme preparation, kinetic analysis and standard bioinformatics techniques.

To analyze experimental protocols, perform standard biochemical calculations, critique data, and prepare results for oral or written presentation.

D. **Pre-requisites:** Organic Chemistry II and Biology I
   SMTE-0093 (Chemistry Lab Safety Seminar)

   **Co-requisites:** Lab attached to this course

E. **Required Textbook(s), readings and supplies**


   Note: The older version (6th ed.) is usable except the page numbers quoted in the study guidelines may be shifted.

   **Optional Textbook(s) or Other References:**

   SaplingPlus with Lehninger
   Biochemistry: Lippincott’s Illustrated Reviews, Champe, Harvey and Ferrier
F. Student learning outcomes and assessment

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course students should be:

1. Able to recognize the role of physical forces operating between atoms and ions.
2. Familiar with the building blocks of proteins, DNA, and sugars.
3. Proficient in the basic principles of protein and DNA structures.
4. Aware of enzyme kinetics and the importance of catalysis in biological systems.
5. Knowledgeable in the role of lipids and membrane structure in cells.
6. Able to comprehend a variety of themes in biochemistry and laboratory skills as listed above.
7. Well-informed at the biochemical level to take medical, pharmaceutical, and health-related professional entrance exams such as MCAT, PCAT, and others.

Assessment of students learning is based on the lecture exams, laboratory performance, and quizzes throughout the semester as detailed below.

G. Instructional methods and activities

Lectures will be followed by a review of chapters, problem solving, and student participation.

H. Major course requirements and grading

Attendance: Attendance is highly recommended to understand the concept in its true perspective. That is to connect different aspects of chemical principles to understand a specific phenomenon. Irregularity inevitably leads to poor grade. Please arrive on time and remain in the class until the lecture is completed. Arriving later than 10 minutes after the start of the class or leaving early is not acceptable in the interest of the whole class. Since this course has long lecture sessions (2 hours), there will be a short intermission (10 minutes). Students who are late to the first session are advised to wait for the second session to join the class. Please minimize distractions in the class as some
students tend to go out for a drink of water or restroom use. Keep in mind if few students do this in a large class (about 40 students) this will be too much of a disturbance. Please be aware that some of your own classmates are not comfortable with that type of disturbances. I suggest that you plan appropriately so that you do not have to leave the class in between the start and the conclusion of the lecture. Please avoid whispering with your neighbors as it is known to distract students in the vicinity. Please note, the class time belongs to all the students and the teacher, therefore, we need to be mindful of others that means we together must avoid disturbances whatsoever!

**Lecture Exams:** There will be two semester examinations in addition to a comprehensive final examination. Examinations will be predominantly multiple choices but may include short answer, brief calculation or structure drawing questions. All answers on exam scantron cards are final, so please fill in your answer choices on your scantron card carefully.

<table>
<thead>
<tr>
<th>Exam</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>100</td>
</tr>
<tr>
<td>Exam 2</td>
<td>100</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
</tr>
</tbody>
</table>

**Total** 300 pts

Exams will take place during regular class time. Please inform Dr. Narayana ahead of time if you have a university-approved excuse, if at all possible, alternate arrangements can be made. I will not “drop” any of the examinations in the calculation of your final grade.

**Course Grading:** A combined grade for both lecture and laboratory will be given for the course. The lecture component will count for 75% of the grade and the laboratory component for 25%. The scale below indicates the minimum course score (out of a possible 100) required to obtain a particular grade. **In the lecture class, 5% of your grade will be set apart for attendance and/or quizzes.**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90</td>
</tr>
<tr>
<td>B</td>
<td>80</td>
</tr>
<tr>
<td>C</td>
<td>70</td>
</tr>
<tr>
<td>D</td>
<td>55</td>
</tr>
<tr>
<td>F</td>
<td>&lt;55</td>
</tr>
</tbody>
</table>

The course score is calculated by adding the lecture (70 + 5) and laboratory (25) scores:

Lecture score: \[
\frac{\text{exam points} + \text{quiz points}}{300} \times 70
\]

Laboratory score: \[
\frac{\text{lab reports} + \text{worksheets} + \text{exam points}}{25}
\]
As mentioned above, there are 300 points possible in lecture from the three regular and one final examination. There will be a total of 190 points that can be earned in the laboratory component of the course from lab reports, worksheets, mid-term exam, final exam and laboratory performance. Please note that a good score needs to be obtained in BOTH lecture AND laboratory in order to obtain a good overall grade for the course. DO NOT expect a good lab score to boost a weak lecture score by a full letter grade.

**Study guidance:** Keep up with the reading, do end-of chapter problems, come to class, review and annotate your notes. I suggest that you prepare one or two pages summary of the material covered in the class on all class days. This will help you review faster as well as to connect with materials covered later. It is extensive, so begin early and keep up with the material as we proceed through the semester. Read or at least skim through the material discussed in the previous class before attending the class. Because the class material builds on itself, you cannot afford to get behind. In line with the adage – “well begun is half done”, I urge students to keep up with the subject as we proceed through the semester. An additional, study guide (Osgood and Ocorr) is available on reserve at the library. Forming a study group with other students is another strategy many students find helpful.

## I. Course content/schedule

**Tentative Lecture Course Outline**

*Disclaimer: This syllabus is subject to change*

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading Chapter: pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 08</td>
<td>Introduction/Foundations</td>
<td>1:1-11</td>
</tr>
<tr>
<td>July 09</td>
<td>Foundations</td>
<td>1:1-11</td>
</tr>
<tr>
<td>July 10</td>
<td>Cells &amp; Organelles</td>
<td>1:1-11</td>
</tr>
<tr>
<td>July 11</td>
<td>Biomolecules/Reactions</td>
<td>1:11-29</td>
</tr>
<tr>
<td>July 15</td>
<td>Biomolecules/Reactions</td>
<td>1:11-29</td>
</tr>
<tr>
<td>July 16</td>
<td>Water</td>
<td>2:47-70</td>
</tr>
<tr>
<td>July 17</td>
<td>Water/Amino acids</td>
<td>2:47-70, 3:76-85</td>
</tr>
<tr>
<td>July 18</td>
<td>Amino acids/Exam 1</td>
<td>3:76-89</td>
</tr>
<tr>
<td>July 22</td>
<td>Protein Structure</td>
<td>4:115-152</td>
</tr>
<tr>
<td>July 23</td>
<td>Protein Function: Ligand binding</td>
<td>5:157-184</td>
</tr>
<tr>
<td>July 24</td>
<td>Protein Function: Ligand binding</td>
<td>5:157-184</td>
</tr>
<tr>
<td>July 25</td>
<td>Enzymes: General function/kinetics/Exam 2</td>
<td>6:189-213</td>
</tr>
</tbody>
</table>
Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. Course policies

Attendance/Tardiness

Students are encouraged to attend all lecture classes. Attendance will be taken in the class and 5% of the total grade is allocated for attendance. I believe this provides an incentive to students to attend the classes as well as to learn and be ahead.

Late Work and Make-up Exams

Please inform Dr. Narayana ahead of time if you have a university-approved excuse, if at all possible, alternate arrangements can be made.

Extra Credit

Depending on the class performance there may be an opportunity for extra credit to enhance the students’ grade points via assignments or quizzes. However, please note this is not a routine procedure and not an obligation for the course. I shall decide on extra credits during the course of the semester.

Cell Phone Use

Cell phone use and photography is prohibited in the class room. This is a severe distraction to the entire class. Cell phones are not allowed during all quizzes and exams or you will receive a zero!!
Laptop Use

Use of laptop in the class is permitted provided it is used solely for taking notes related to the ongoing lecture in the class room. Further its use should not distract or interfere with other students in the class.

Food in Class

Although food is allowed in the lecture classes, please consume only as a necessity on some occasions and ensure it does not distract the neighbors.

Missed Exam

If a student is absent for the exam on the designated date, he or she should provide a university-approved permission to take the exam at a mutually convenient date. In regards to the quiz, if a student is absent on the day of the quiz, the student forfeits the quiz points unless there is a university-approved excuse.

Participation

Students are encouraged to participate collectively in the class discussion and should not involve in cross talk with the neighbors privately on the subject matter during the lecture period. You are expected to be attentive and ask or answer pertinent questions.

Others

Decorum: The best way to encourage learning is to provide an environment conducive to listening, concentration, and discussion. As in any class, students are expected to maintain the highest standards of decorum and to conform to college-level standards of ethics and academic integrity. Please note that I am very sensitive for disturbances so does many students if not all, so I urge all students to be focused throughout the class time (only for about 2 hours please!). Cell phone use and photography is prohibited in the class room. Please turn OFF your cell phone while in the class. Electronic interruptions will NOT be allowed, and laptops are to be used only for the lecture material. Most of these involve common sense and courtesy. All students are expected to treat other students and the instructor with due respect. If a student’s behavior breaches the general code, the student will be asked to leave the class and continued miss-conduct can lead to further disciplinary action. Please refer to the section on academic policies and regulations in the university catalog for a more thorough description of these expectations.

Student responsibility: Student should be aware of the contents of this syllabus and the course website on Blackboard. Announcements and changes are communicated in the classroom, Blackboard, and/or emails.
K. College and University policies

Academic Integrity (University)

University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

Classroom/Professional Behavior

Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

Statement of Civility

Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

Deadline for Dropping a Course with a Grade of W (University)

I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.
Grade Appeals (College of Science and Engineering)

As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the [University Rules website](http://www.tamucc.edu/provost/university_rules/index.html), and the [College of Science and Engineering Grade Appeals webpage](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

Disability Services

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816. [http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)

Statement of Academic Continuity

In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. Other information

Academic Advising
The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

**General Disclaimer**

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.

**Biochemistry Laboratory I Schedule**

**Tentative Course Outline**

*Disclaimer: This syllabus is subject to change*

**MW (or TR): 12:00 – 4:25 PM CS 228**

<table>
<thead>
<tr>
<th>Date</th>
<th>Lab</th>
<th>Topic</th>
<th>points</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>10/11</td>
<td>0 Introduction</td>
<td>-</td>
</tr>
<tr>
<td>July</td>
<td>10/11</td>
<td>1 Units, Concentration, Solutions &amp; Dilutions (worksheets*)</td>
<td>15</td>
</tr>
<tr>
<td>July</td>
<td>10/11</td>
<td>2 Pipetting &amp; Scales (worksheet)</td>
<td>10</td>
</tr>
<tr>
<td>July</td>
<td>15/16</td>
<td>3 Buffers &amp; pH (lab report)</td>
<td>17</td>
</tr>
<tr>
<td>July</td>
<td>15/16</td>
<td>4 Photometry Introduction (lab report)</td>
<td>17</td>
</tr>
<tr>
<td>July</td>
<td>17/18</td>
<td>5 Photometry &amp; Amino Acid Chromatography (lab report)</td>
<td>17</td>
</tr>
<tr>
<td>July</td>
<td>17/18</td>
<td>6 Protein Structure Analysis (worksheet)</td>
<td>10</td>
</tr>
<tr>
<td>July</td>
<td>22/23</td>
<td>7 Enzyme Activity: Polyphenol oxidase (lab report)</td>
<td>33</td>
</tr>
<tr>
<td>July</td>
<td>22/23</td>
<td>8 <strong>Mid-term exam (10)</strong>/Enzyme Kinetics</td>
<td>10</td>
</tr>
<tr>
<td>July</td>
<td>24/25</td>
<td>9 Protein Quantification (worksheet)</td>
<td>10</td>
</tr>
<tr>
<td>July</td>
<td>24/25</td>
<td>10 Glucose determination (lab report)</td>
<td>17</td>
</tr>
<tr>
<td>July</td>
<td>29/30</td>
<td>11 Nucleic Acids (lab report)</td>
<td>17</td>
</tr>
<tr>
<td>July</td>
<td>29/30</td>
<td>12 Lab clean-up (5), Checkout (2) &amp; <strong>Final Exam (10)</strong></td>
<td>17</td>
</tr>
</tbody>
</table>

Total: 190

*Note: Worksheets and Lab reports of a particular week are due on the following Monday.*