

Fall 2016 Medicinal Chemistry Approach to CHEM106 General Chemistry II 001 (Owens) Syllabus

This syllabus is a living document; students must check the syllabus posted on the Department web site <http://chem.winthrop.edu/> for any changes prior to every class attendance

- Three lecture hours per week, three credit hours
- Dates reflect M,W lecture days for Fall 2016 semester

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- Office Hours: SIMS312A- MW 3:30-5:00 PM

Required Course Texts: Students are required to have their chemistry textbook from CHEM105

- *General Chemistry, 4th Edition*, McQuarrie, Rock and Gallogly, 2011

Course Objectives:

- Strengthen thinking skills, improve study habits, and demonstrate ability to learn fundamental principles from large amounts of scientific information.
- Develop a understanding of relevant chemistry in molecular medicine and neuroscience.
- Learn fundamental chemical science principles necessary to understand the scientific basis for molecular medicine

Course Outline: This is the second half of General Chemistry, an introductory chemistry course for science and engineering majors. This course focuses on learning chemistry by examining molecular medicine. Fundamental General Chemistry principles such as molecular structure, solubility, noncovalent interactions, thermodynamics, equilibria, kinetics, and electrochemistry represent the primary reasons for how and why drugs work. Students leave this course with both with a better understanding of relevant chemistry principles and fundamental insights into the scientific basis of modern medicines. This knowledge is useful for future science courses, is very helpful in better understanding human health at the molecular level, and is extremely important in being able to make informed decisions as scientifically literate citizens in a society increasingly engaged with molecular medicine.

Perhaps most importantly, molecules that enter our bodies are of tremendous human interest, whether these substances be medications, nutrients, toxins, or substances of abuse. Learning science by understanding how these molecules interact with and affect us can be a very rewarding and enriching experience. Such knowledge and insight can also lead to discoveries that help to improve the quality and length of human life.

The thematic approach being used in the course is organized in the following manner:

- The first third of this course reviews the fundamental chemical principles needed to be mastered to understand how drugs work.
- The middle third of the course examines anti-inflammatory therapeutics, steroids, cancer treatments, and receptor drug targets. It begins with the mechanisms of action for medications used to treat inflammation; recent discoveries demonstrate that inflammatory processes are centrally important in cancer, cardiovascular disease and metabolic-syndrome related illnesses. This part of the course covers a broad array of receptor drug targets (nucleic acids, ion channels, GPCRs, kinase-linked receptors) and closely examines receptor-drug interactions and the design of medications to modulate these.
- The final third of the course centers on neuroscience; most drugs work by targeting nerve receptors; a good understanding of neuroscience is essential. The final half of this block covers a broad spectrum of

classes of psychoactive drugs. Several classes involve drugs that are most widely abused in modern societies. Most of the other classes are used to treat mental illnesses. According to the National Institute of Mental Health, mental illness is the leading cause of disability for ages 18-44. Mental disorders are common in the United States and internationally. An estimated 26.2 percent of Americans ages 18 and older suffer from a diagnosable mental disorder in a given year. Understanding how these are being treated and the mechanism of action for these medications is an important part of becoming an educated citizen.

Schedule: Lectures are scheduled twice weekly at the appointed hour and location. The course syllabus provides the specific schedule as the semester progresses. All course information is posted on the chemistry department's web page (chem.winthrop.edu).

Final Exam: Students must take the final exam with their section.

- CHEM106 class that meets Monday at 08:00 AM will have its final exam at 08:00 AM December 13, 2016.

Class Preparation: This is both a very interesting and a very challenging course. Once a principle is covered during a lesson, students will be expected to demonstrate an understanding of that concept throughout the remainder of the semester. Lecture discussions will assume that students understand material from previous lessons. Graded problems throughout the course often cannot be answered without being able to successfully apply previously discussed principles. It is very important for students to continuously review course material. Athletes practice every day, often for years, to master specific skills. Successful students (and faculty) have learned to continuously reexamine those topics and principles that are not completely clear to them. Students are also encouraged to study in groups; teaching peers is perhaps the most effective way to learn chemistry.

Students are responsible for all assigned study material and for all material discussed in lecture. A great deal of important information will be provided during lecture; take excellent notes!! Lectures are not designed to reiterate assigned readings but to focus on conveying important information from various sources to understand the General Chemistry concepts that represent the molecular basis of modern medicine. You are expected to spend whatever time it requires to develop and to demonstrate an understanding of these subjects and lecture materials. You must complete each reading and problem assignments **prior** to class. For each class I recommend that you do the following:

- Study previous lecture notes; you are strongly encouraged to organize and rewrite them immediately after each lecture.
- Study and review course material topics relevant to previous class discussions.
- Read assigned lesson for upcoming lecture, take notes and identify questions
- Work assigned problems

Student Competencies: Assigned chapters, class discussion, homework, problem sets, unannounced quizzes, announced quizzes, tests, and the final exam will all center on development and evaluation of student competencies. Students should expect to face challenging and unfamiliar questions on all graded work; this is done to focus attention on competencies that students have not yet fully mastered. Students can be evaluated five to six separate times on a given competency: homework problems, unannounced quizzes, problem sets, announced quizzes, tests, and the final exam. Students are urged to not fall behind and to master each competency as soon as it is first examined.

The course web site will itemize chapter sets of student competencies to more effectively focus student study and to allow student self-evaluation of progress. Links to quizzes given to date will be added to the syllabus schedule as they are returned. Solutions to problem sets and to quizzes will not be posted since more effective student learning occurs through working through these problems individually. Class time will be used to review the quiz and test questions that challenged students most. Periodically, as time allows, graded problem sets will be reviewed in class.

Graded Exercises

- Quizzes will be routinely be given, each be worth 30 points, and often be given at the beginning of class. These quizzes will include questions to evaluate understanding of material covered during the previous lecture as well as questions to evaluate competency in problem solving skills from sets due that day.
- Assigned problem sets will each be worth 15-30 points; only specific problems will be graded. Problem sets are due at the beginning of class; no credit will be given for sets turned in late.
- The assigned review paper will be weighted 75 points.
- Two tests will be given and be weighted approximately 150 points each.
- The cumulative final exam will be worth at least 300 points. You must score better than 50% on the final exam to pass the course. You must score an A on the final exam to earn an A in the course.

Grades: Percentages will be calculated based upon total earned points divided by total points tested. There will be no makeups for graded exercises. You must score an A on the final exam to earn an A in the course. The following grade range will be used: A = 93.00-100%; A- = 88.00-92.99%; B+ = 85.00-87.99%; B = 80.00-84.99%; B- = 76.00-79.99%; C+ = 72.00-75.99%; C = 66.00-71.99%; D = 56.00-65.99%; F = <56.00%

Attendance: You are expected to attend all class meetings for the full scheduled time. A student who is absent for any reason is responsible for obtaining the assignments from the instructor or a classmate. Roll will be taken occasionally and the attendance practices of students will be taken into account when final grades are assigned. Absence from a test or quiz without a written doctor's excuse or similar external agency valid documentation is inexcusable. An unexcused student absence will result in a zero for the missed grade AND a deduction of 20-100 points (determined by the weight of the missed test) from the student's previously earned points in the course. For excused absences, missed exercises will not be included in neither the earned nor total points when calculating overall course grades.

University Competencies: CHEM 106 and the co-requisite CHEM 108 together primarily develop students in the first University Competency: *Winthrop graduates think critically and solve problems. Winthrop University graduates reason logically, evaluate and use evidence, and solve problems. They seek out and assess relevant information from multiple viewpoints to form well-reasoned conclusions. Winthrop graduates consider the full context and consequences of their decisions and continually reexamine their own critical thinking process, including the strengths and weaknesses of their arguments.* Some (but not all) of the ways that this competency is strengthened in CHEM106 include extensive quantitative problem solving, explanation of mechanisms of actions for complex human-drug interactions, and the application of thermodynamics and electrochemistry to predict membrane potentials, spontaneity, and hyperpolarization effects across cell membrane ion concentration gradients.

General Education Requirements: CHEM 106 and the co-requisite CHEM 108 together fulfill four hours of general education requirement for natural sciences. Listed below are Winthrop's seven fundamental student learning outcomes for natural science courses as well as examples of how they will be fulfilled in CHEM 106 and 108.

Students should be:

1. *Conversant with a few fundamental concepts from among the three main areas of natural science, including earth, life, and physical sciences.* (e.g., enzyme kinetics, protein structure, mechanism of action for psychoactive substances, dose-response toxicological curves).
2. *Able to apply the scientific methodologies of inquiry.* (e.g., CHEM 108 laboratory exercises and experiments)
3. *Able to discuss the strengths and limitations of science.* (e.g., effectiveness and adverse side effects of medicine, limitations of medication, treating inflammation)
4. *Able to demonstrate an understanding of the history of scientific discovery.* (history of human substance abuse, development of aspirin and heroine by Bayer, initial inclusion of cocaine in Coke)
5. *Able to discuss the social and ethical contexts within which science operates.* (e.g., exposure of humans to known carcinogens; addiction to nicotine, toxicity testing and side effects).
6. *Able to communicate about scientific subjects including (lab courses only) the defense of conclusions based on one's own observations.* (e.g., CHEM 108 laboratory presentations and project reports)
7. *Able to discuss the application of scientific knowledge to the social sciences and to non-scientific disciplines.* (the entire course does this)

Students with Disabilities/Need of Accommodations for Access: Winthrop University is committed to providing access to education. If you have a condition which may adversely impact your ability to access academics and/or campus life, and you require specific accommodations to complete this course, contact the Office of Accessibility (OA) at 803-323-3290, or, accessibility@winthrop.edu. Please inform me as early as possible, once you have your official notice of accommodations from the Office of Accessibility.

Student Conduct Code: “Responsibility for good conduct rests with students as adult individuals.” The policy on student academic misconduct is outlined in the “Student Conduct Code Academic Misconduct Policy” in the online *Student Handbook*

<http://www.winthrop.edu/uploadedFiles/studentconduct/StudentHandbook.pdf>