Chemistry 3405
Physical Chemistry of Biomolecules
Spring Semester 2018

Instructor: Dr. Spiridoula Matsika,
Office: Beury 242, Phone: 1-7703, e-mail: smatsika@temple.edu
Office Hours: Mon, Tue, Thu: 1-2pm, or by appointment
TA: Mohammad Balooch Qarai, e-mail: MBQarai@temple.edu

Lecture: 11:00 AM  12:20 PM  T R  Wachman 213
Recitations: 3:00 PM  3:50 PM  M  BE 415/Computer lab BE 220
            3:00 PM  3:50 PM  W  BE 415/Computer lab BE 220

Text: “Physical Chemistry for the Life Sciences” by P. Atkins and J. de Paula
2nd ed.

Prerequisites: Chemistry 1032 or 1042 or 1952

Co-Requisites: Mathematics 2043 or 3043-3044 or 3137-3142 or 4051-4063 and
Physics 1062 or 2022 or 2922 or 2101-2701 or 3101-3701 or 4101-4796,
Chemistry 4401

Course Description: CHEM 3405 is a lecture/recitation based survey course that covers those aspects of
physical chemistry of use to biochemists in understanding the physical properties of
biologically significant molecules and structures. Topics to be covered include
thermodynamics, colligative properties of matter, electrolytes, enzyme kinetics,
quantum theory, and spectroscopy.

Grading: Recitation/Homework: 24%
         Midterm 1: 23%
         Midterm 2: 23%
         Final: 30%

Homework: Weekly homework problems will be posted on blackboard and will be collected in
class on the due date. Late homework will not be accepted without prior consent of
the instructor.
Recitation:
Recitation will be a combination of Homework Q&A, discussion of literature and computer lab exercises/projects. Many recitations will be taken up with how to use software such as SPARTAN, CHIMERA, WEBMO and SIMBIOLOGY. These packages are available free of charge through a University license and can be downloaded onto your laptop/computer. The TA will run several tutorial sections to get you familiar with these programs.

Exams:
There will be two midterm exams: the first on 2/20/2018 and the second on 4/3/2018. The final exam will be on 5/8/2018.

Important Dates
First class: Tuesday, January 16
Last day to drop (tuition refund available): Monday, January 29
Midterm Exam 1: 2/20/2018
Spring Break: March 5 - March 11
Last day to withdraw (no refund): Wednesday, March 21
Midterm Exam 2: 4/3/2018
Classes End: Monday, April 30.
Final Exam: 5/8/2018

Topics:

I. Microscopic Systems and Quantization / Chapter 9
   • The origins of Quantum Mechanics
   • The Schrödinger equation/ Wavefunctions
   • Uncertainty Principle
   • Translational motion
   • Rotational motion
   • Vibrational motion
   • Hydrogenic Atoms
   • Many-electron atoms

II. The Chemical Bond / Chapter 10
    • Valence-Bond theory
    • Molecular orbital theory
    • Diatomic /Polyatomic molecules

III. Intermolecular Interactions/ Chapter 11
     • Coulomb interactions/dipoles etc.
     • Biomolecular Structure

IV. Optical Spectroscopy / Chapter 12
    • Beer-Lambert Law
• Transition dipole moments/selection rules
• Vibrational Spectra/IR/Raman
• UV/Vis spectra/ Fluorescence/Phosphorescence/FRET

V. Determination of Structure/ Chapter 11
• Mass spec/SAXS/x-ray diffraction
• X-ray crystallography

VI. Thermodynamics: First Law/ Chapter 1
• Conservation of Energy/Heat Capacity
• Internal Energy and Enthalpy

VII. Thermodynamics: Second Law/ Chapter 2
• Entropy
• Gibbs Free energy
• Chemical potential

VIII. Chemical Equilibrium/ Chapter 4
• Equilibrium constants
• Van ’t Hoff equation
• Acid/Bases
• Protein-ligand binding equilibrium

IX. Kinetics /Chapters 6-8
• Reaction rates
• Integrated rate laws
• Rate laws for zero, first and second order reactions
• Arrhenius equation
• Relaxation to equilibrium
• Steady-state approximation
• Diffusion
• Enzymes

Disability disclosure statement
Any student who has a need for accommodation based on the impact of a documented disability, including special accommodations for access to technology resources and electronic instructional materials required for the course, should contact me privately to discuss the specific situation by the end of the second week of classes or as soon as practical. If you have not done so already, please contact Disability Resources and Services (DRS) at 215-204-1280 in 100 Ritter Annex to learn more about the resources available to you. //we will work with DRS to coordinate reasonable accommodations for all students with documented disabilities.

Temple Policy on Student and Faculty Academic Rights and Responsibilities
Freedom to teach and freedom to learn are inseparable facets of academic freedom. The University has adopted a policy on Student and Faculty Academic Rights and Responsibilities (Policy # 03.70.02) which can be accessed through the following link: http://policies.temple.edu/getdoc.asp?policy_no=03.70.02