PRAIRIE VIEW A&M UNIVERSITY • DEPARTMENT OF CHEMISTRY

CHEM 5783-001: PHYSICAL CHEMISTRY

Professor:	**Dr. Kanu, Abu B.**	Office:	**213**
Class Hours:	**M 4:00-7:00 pm**	Phone:	**(936) 261-3104/(509) 312-0807**
Office Hours:	**W 5:00-6:30 pm**	E-mail:	**abu_kanu_01@yahoo.co.uk**

CATALOG DESCRIPTION:

CHEM 5783. Advanced Physical Chemistry. (3-0) Credit 3 semester hours. A lecture course dealing with advanced topics of special interest in modern physical chemistry in areas including experimental and theoretical thermodynamics, chemical kinetics, collision and transition state theories, atomic and molecular spectra, quantum mechanical systems, photochemistry, structure of crystals and liquids, surface chemistry, macro-molecules, and gas phase reactions. Prerequisites: CHEM 3413-3423 and Mathematics through Differential Equations (MATH 2043).

TEXTBOOK:

Physical Chemistry (1st Edition) by David W. Ball; ISBN: 0534266584, Brooks Cole Publisher.

COURSE GOALS:

CHEM 5783 is a lecture course focusing on advanced principles of Physical Chemistry. The course reinforces and expands the study of elementary chemical kinetics and reaction transition theory, elements of quantum theory, and molecular spectroscopy . The course reviews and advances the underlying theory of chemical phenomena through theoretical and practical problems. Many activities will require use of computer skills as an adjunct to enhancement of problem-solving abilities and further development of the ability to synthesize and apply knowledge in new contexts.

Course Learning Objectives/Accrediting Body *American Chemical Society (ACS)*
Standards Met: A, C, E, F

At the end of this course, the student will

- Demonstrate mastery of how to derive and apply rate equations for chemical reactions
- Demonstrate mastery of the concept of the order of a reaction with respect to one reactant and to the overall order
- Demonstrate mastery of the definition of rate constant and a rate coefficient
- Demonstrate mastery of the role of temperature and use of the Arrhenius Equation for determining reaction rates and Activation Energies
- Demonstrate a working knowledge of classical electromagnetic theory
- Demonstrate mastery of the Bohr Model and its role in the development of Quantum Mechanics
- Characterize the historical development of quantum mechanics and the way that its postulates led to the formulation of modern quantum mechanics.

- Critically reflect on the central role of the Schrodinger Equation to explain simple systems
- Critically reflect on how chemical spectroscopy is concerned with a coupling mechanism between classical electromagnetic waves and quantum mechanical atoms and molecules
- Critically explain how absorption, spontaneous emission, and stimulated emission are described by the Einstein coefficient and provide the basic theoretical framework for chemical spectrometers
- Explain the role of electric and magnetic moments in chemical systems and their importance to spectroscopy
- Explain the different spectroscopic studies in the various electromagnetic regions and how these relate to chemical structure
- Explain the difference between absorption spectroscopy and Raman spectroscopy
- Explain the role of thermodynamics in Chemical reactions and mechanisms

COURSE EVALUATION:

Homework (3)	300 pts
Exams/quizzes	400 pts
Final Paper:	300 pts

Grading System: 1000-900: A; 899-800: B; 799-700: C; 699-600: D; <600: F

Make-up Exams: Students with excused absences will be allowed to take make-up exams within a limited period of time and at a time designated by instructor. There will be no finals for the course.

COURSE OUTLINE:

Unit
Ch 1: Gases & the Zeroth Law of Thermodynamics
Ch 2: First Law of Thermodynamics
Ch 3: Second & Third Law of Thermodynamics
Ch 4: Free Energy & Chemical Potential
Ch 5: Introduction to Chemical Equilibrium
Ch 6: Equilibria & Single Component Systems
Ch 7: Equilibria & Multi-Component Systems
Ch 8: Electrochemistry & Ionic Solutions
Ch 9: Pre-Quantum Mechanics
Ch 12: Atoms & Molecules
Ch 14: Rotational & Vibrational Spectroscopy
Ch 19: The Kinetic Theory of Gases
Ch 20: Kinetics

Note: The course is expected to cover at least 12 of the chapters outlined above. An exam/quiz will be scheduled at the end of each chapter.

Notes on Final Paper
The paper must contain the following sections and should be written to a **12 page limit**.

a) Abstract [40 points]
b) Introduction [60 points]
c) Possible Methods (also state what is the best method out of those you selected) [50 points]
d) Explanation of results of interest [60 points]
e) Conclusion (60 points)
f) References (30 points)

Topics for papers will be handed out on the first class. The selection of topics will be on a first come first serve basis. As soon as you select your topic for your paper, you should shoot me an email. At the time of receiving your email, if the topic chosen has been selected by another person, I will respond to your email to let you know what topics are still available. If you do not receive a reply to your email, it simply means your topic selection was accepted. Further details of the papers will be discussed at the time topics are handed out.