CHE 1400: FUNDAMENTALS OF PHYSICAL CHEMISTRY 4.5 UNITS
Pre-requisite – None

3.2.1.1 Purpose of the Course

This course presents the study and principles of the laws that govern chemical reactions in physical chemistry as applied to many areas of analytical chemistry research and development.

3.2.1.2 Expected Learning Outcomes of the Course

Upon completion of this course, students should be able to:

1. Describe the chemical and physical equilibrium;
2. Describe the procedures and practical tasks of physical chemistry and instrumental methods applied in analytical chemistry
3. Explain redox reaction and electrochemical principles used in physical chemistry
4. Use the knowledge of physical chemistry in solving some chemical problems in chemical analysis.
5. Define reaction rate and explain the difference between instantaneous rate and average rate. Define and provide examples of a rate law, rate constant, and reaction order.
6. Explain the professional and safety measures to be taken when working with physical systems.

3.2.1.3 Course Content

The behavior of gases in terms of the Kinetic molecular theory of gases, ideal gas laws, and the Van – der Waal's equation. The Maxwell-Boltzmann distribution as it relates to physical equilibria; Raoult's Law and its application to distillation; Solid – liquid equilibrium (SLE) and Liquid – Liquid equilibrium (LLE) and their applications in colligative properties for the determination of relative molecular mass and the distribution law and steam distillation respectively. Chemical equilibria as it apply to reversible chemical reaction, equilibrium constants and Le Chatelier's Principle; Ionic equilibria will be presented to explain the ionization of water and the concept of acids/bases/salts and the theory of acid/base indicators. The concept of chemical equilibria will also be used to discuss solubility and solubility products as well as factors affecting solubility. Other concepts that will be covered include; Arrhenius theory of dissociation, ideal and non-ideal solutions; Henry's and Raoult's laws; Debye-Huckel theory; fundamentals of electrochemistry in relation to interactions in electrolyte solutions and balancing of redox reactions. Basic definitions: elementary and complex reactions mechanisms, molecularity of elementary reactions; Rate equations; Order of reaction, rate constant, half-life; Methods of determining rates and orders of reaction of chemical reactions.

Lab Sessions

The practical component of the course is a 1.5 credit which will be a one three- hour session per week. It will provide the students with the skills for safe and effective laboratory practice. The students will learn how to measure physical and chemical properties of gases and their applications. Experiments will include determination of equilibrium constant, physical and chemical measurements, solubility curves of different salts, redox titrations, and determination of dissociation constants among others.

3.2.1.4 Mode of delivery:
The teaching methodology for all Chemistry courses will consist of lectures, discovery learning, problem-based learning, experimental learning, group-based learning, independent studies and e-learning, video demonstrations, class discussions, laboratory practicals.

3.2.1.5 Instructional Materials and / or Equipment:
These will include Projectors, Computers, White boards/black boards and Flip charts

3.2.1.6 Course Assessment:

Class attendance	10%
Assignments	20%
Practical's	15%
Quizzes	10%
Mid-Semester Exam	20%
Final Exam	25%
TOTAL	100%

3.2.1.7 Core Reading Materials
Textbooks
1. Darell Ebbing and Steven Gammon (2015). General Chemistry 11th Edition. Cengage Learning.
2. Atkins P. J., De Paula. (2014). Atkins' Physical Chemistry, 10th Revised Edition. Oxford University Press, Oxford
3. Harris, D.C. (2016). *Quantitative Chemical Analysis* 10th Edition. Cranbury NJ: W. H. Freeman Publishers**.**