Department of Chemistry

College of Science

University of Salahaddin

Subject: Principle of analytical chemistry & Volumetric analysis

Course Book – (Year 1)

Lecturer's name: Dr. Hunar Yasin Muhammad

Academic Year: 2022/2023

Course Book

<table>
<tr><td>1. Course name</td><td>Principle of Analytical chemistry & Volumetric analysis</td></tr>
<tr><td>2. Lecturer in charge</td><td>Dr. Hunar Yasin Muhammad</td></tr>
<tr><td>3. Department/ College</td><td>Chemistry/Science</td></tr>
<tr><td>4. Contact</td><td>e-mail: Hunar.Muhammad@su.edu.krd</td></tr>
<tr><td>5. Time (in hours) per week</td><td>Theory: 2</td></tr>
<tr><td>6. Office hours</td><td>Monday: 10:30 – 11:30
Tuesday: 10:30 – 11:30
Wednesday: 10:30 – 11:30
Thursday: 10:30 – 11:30</td></tr>
<tr><td>7. Course code</td><td></td></tr>
<tr><td>8. Teacher's academic profile</td><td><u>Academic achievements and Qualifications:</u>
<table>
<tr><th>From-To</th><th>Degree</th><th>College-University</th><th>Country</th></tr>
<tr><td>2009-2011</td><td>M. Sc. in Analytical Chemistry, Department of Chemistry</td><td>College of Science-University of Salahaddin</td><td>Iraq</td></tr>
<tr><td>2001-2006</td><td>B.Sc. Chemistry, Department of Chemistry,</td><td>College of Science-University of Salahaddin</td><td>Iraq</td></tr>
<tr><td>2015-2020</td><td>PhD. In Analytical Chemistry, Department of Chemistry</td><td>College of Science-University of Salahaddin</td><td>Iraq</td></tr>
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<u>Teaching Activities</u>
<table>
<tr><th>From-To</th><th>Subject</th><th>Stage-College</th><th>University</th></tr>
<tr><td>2011 to 2015</td><td>Analytical Chemistry-
Gravimetric Analysis/prac.</td><td>2nd - stage / Chemistry Department-College of Science</td><td>Salahaddin University</td></tr>
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	2013 to 2016	**Information technology (word- Chemoffice program)**	**1st- stage/ Chemistry- Department- College of Science**	**Salahaddin University**
	2011 to 2013	**Analytical Chemistry**	**2nd - stage / dept. of science/Basic School/Faculty of Education**	**Soran Universty**
	2016 to 2018	**Analytical Chemistry**	**1st and 2nd - stage / Chemistry Department- College of Science**	**Soran Universty**
	2014-2015	**Instrumental analysis/prac.**	**4th - stage / Chemistry Department- College of Science**	**Salahaddin University**
	2016 to 2021	**Separation method**	**3rd - stage / Chemistry Department- College of Science**	**Salahaddin University**
	Now	**Principle of Analytical chemistry & Volumetric analysis**	**1st - stage / Chemistry Department- College of Science**	**Salahaddin University**
9. Keywords	Properties of solution, Concentration, Equilibrium, pH Calculation, Titrations			

10. Course overview:

The course examines Principle of Analytical chemistry & Volumetric analysis from a unified point of view. The course is not a compilation of all. It provides a framework of Principle of

Analytical chemistry & Volumetric analysis. The idea is to classify all solution properties, Concentration, Equilibrium, pH Calculation and Titrations.

Analytical chemistry is a measurement science consisting of a set of powerful ideas and methods that are useful in all fields of science and medicine. Analytical chemistry deals with methods for the identification, determination and separation of compounds in a mixture.

11. Course objective:

The aim of the course is to provide the students with the needed tools so that they can understand all of principles of analytical chemistry including all solution properties, Concentration, Equilibrium, pH Calculation and Titrations.

12. Student's obligation

The students must be done at least One examination and some quizzes or daily questions during each semester

- All exams will be given at the posted dates (after selection) and times only. If you encounter an unforeseen case and cannot take the exam on its scheduled date and time, please contact me immediately to discuss your situation.

13. Forms of teaching

Data show and white board

14. Assessment scheme

The students must be done at least One examination and some quizzes or daily questions during the year; and the marks distribute as the following:

1st Exam	5 Marks
2nd Exam	5 Marks
Quizzes or daily questions	5 Marks
Final	50 Marks
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Total	65 Marks

Make-up Exams

- All exams will be given at the posted dates (after selection) and times only. If you encounter an unforeseen case and cannot take the exam on its scheduled date and time, please contact me immediately to discuss your situation.

15. Student learning outcome:

Students should know the basic principles and have actual practice with the operational techniques of a wide variety of analysis. In addition, they should be familiar with a great many other things in analysis such as different concentration expression that may be useful in the future.

On successful completion of these semesters, students should be able to:

1. Understand the different concentration expression

2. Relation between Concentrations, pH calculating for different acid-base solutions, equlibria and Titrations in detail.
3. Able to calculating pH for each point in a titration and constructing curve for each titration

16. Course Reading List and References:

1. Fundamental of analytical chemistry by Douglas A. Skoog and Donald M. West, 4th, 8th edition.
2. Modern analytical chemistry by David Harvey.
3. Principles and Practice of Analytical Chemistry, F.W. Fifield & D. Kealey
4. A Text Book of Quantitative Analysis; By: Vogel
5. Chemical Analysis Modern Instrumentation Methods and Techniques: by F. Rouessac and A. Rouessac.
6. Quantitative Chemical Analysis: By D. C. Harris

17. The Topics:	Lecturer's name
The chemical composition of aqueous solutions	1st week
-Electrolytes, Acids and bases. -Amphiprotic species -Autoprotolysis, Strength of acids and bases	2nd week
-Units of concentrations -Methods for the expression of concentration: -Mole, M.Wt. and Molar concentration	3rd week
-Normal concentration -Preparation of solutions from solid materials	4th
-Preparation of solutions from liquids	5th
Molality Mole fraction (X), Mole percent (n/n%) and Mole ratio (r): Formality Normality	6th
Percentage concentrations Parts-per notation	7th

Relation between Concentrations	8th
p-Function (p-Value) Chemical Stoichiometry	9th
Introduction to Volumetric analysis	10th
Chemical Equilibria Ion-product constant for water (Kw)	11th
Calculation of pH for different acid-base solution Calculation of pH for strong acid or base (not very dilute) Calculation of pH for strong acid or base (very dilute) Calculation of pH for salt of strong acid & strong base	12th
Dissociation Equilibria for weak acids and bases Dissociation Constants for Conjugate Acid/Base Pairs Calculation of pH for weak acid or base	13th
Calculation of pH for salt of Strong acid-Weak base Calculation of pH for salt of Weak acid-Strong base Calculation of pH for salt of Weak acid-Weak base	14th
Buffer solutions Calculation of pH for acidic buffer solution Calculation of pH for basic buffer solution	15th
Equilibrium Constant for slightly soluble salts The effect of a common ion on the solubility of a precipitate	16th

Types of titrations 1- Neutralization titration (Acid-base titration) Acid-Base Indicators Strong Acid-Strong Base Titration Curve	17th
Titrating a Weak Acid with a Strong Base Titrating a Weak Base with a Strong Acid	18th
2- Precipitation titration 1-Mohr's method Titration Curve in precipitation titration	19th
2-Volhard method 3-Fajan method	20th
3-Reduction-oxidation titration (Redox titration). Calculating the Redox Titration Curve	21th
4- Complex Formation Titration (Complexometry)	22th

19. Examinations:

Q : Define the following terms with a proper example

1. *Molarity*
2. *Titration*
3. *End Point*

Q : What are Factors affecting solubility of solids?

Q : How many (Fe) are contained in patient's serum? if the amount of (Fe) in serum equal to 2500 µg. At.Wt Fe = 55.8 g/mol

20. Extra notes:

21. Peer review