Department of Chemistry

College of Science

Salahaddin University

Ꙅubject: Chemical Software and Data Analysis

Course Book – (Stage Two) course 2

Lecturer's name _Assist Prof. Dr Diyar Salahuddin Ali_

Academic Year: 2023/2024

Course Book

1. Course name	**Analytical Chemistry**
2. Lecturer in charge	**Assist Prof. Dr Diyar Salahuddin Ali**
3. Department/ College	**Chemistry / Science**
4. Contact	**e-mail: Diyar.ali@su.edu.krd** **Tel: 0750(xxx) xxxx**
5. Time (in hours) per week	**Theory: 2** **Practical: 3**
6. Office hours	**4**
7. Course code	
8. Teacher's academic profile	**I have more than 20 year experience teaching of Analytical Chemistry, also I have more than 15 papers are published in different local and foreign journals, I got three grand from American organization for supporting my research in Analytical field. Supervising M.Sc. student during my duty in the college. Participation in different conferences and meeting over the world. I worked in e-learning filed too, up to date I am member in Abn Sinna Center for e-learning which supporting form UNESCO.** **B.Sc. of Chemistry from 1994** **M.Sc. of Analytical Chemistry from 1998** **Ph. D of Analytical Chemistry from 2006** **Assist Lecturer** Feb 1998 – March 2006 **Instructor** March 2006 – Feb 2011 **Assist Prof.** Feb 2011 up to date
9. Keywords	**Analytical Chemistry, Analytical Techniques, Gravimetric and statistical**

10. Course overview:

First period covered all gravimetric analysis, the purpose for that for takes the gravimetric analysis in the first semester as continues for Sample Analysis, as we know all sample analysis begin with knowing which is include? (Qualitative), then we must try to calculate it (Quantitative) after that we must try to separate between them, finally if we can't do that by chemical method we changed to Instrumental Analysis.

In the second period we covered all statistical tools which used in the analytical chemistry, we try to solve a huge problems related to this issue, like accuracy, precision, detection limit, determination limit, sensitivity, selectivity , T and F- tests. In our two periods time the students should be achieved for all of the objectives are

preceded by the phrase, "The student should be able to:". As I write before I am responsible for Analytical Chemistry for second stage students which they study just gravimetric analysis and statistical tools, so before we starting with them, the students should they have a good background about Analytical Chemistry principles like meaning of this branch of chemistry and classification and all qualitative process.

11. Course objective:

The student should take all explanation about Introduction to Analytical Chemistry as general, Analytical Chemistry Classification, Simple information about Qualitative Analysis, Quantitative Analysis, Gravimetric Methods of Analysis, Types of Gravimetric Methods Precipitation Gravimetry Mechanism of Precipitate Formation
Chemical formula for precipitate and the calculations in the quantitative analysis, Factors which affected of the solubility precipitate, Mechanism for Precipitation, Factors Affecting Particle Size, History of Statistical Chemistry, Terminology of Statistical Chemistry, The Assessment of Analytical Data, Gaussian distribution, Numerical criteria for selecting an analytical method, precision, accuracy, sensitivity, selectivity, detection limit, determination limit, reproducibility, calibration graph, standard addition…..

12. Student's obligation

The students are required to do at least two closed exam at the mid of each semester besides other assignments and each student must prepare full report at the end of the year. All exams have marks, full report also has marks, the classroom activities count marks and mark for attendance too.

13. Forms of teaching

Our lecture is depend directly on showing the strong point in the lecture via data show depending on the power point program… and solve problem on the white board with the students.

14. Assessment scheme

Mid- semester exam: 10%
Classroom participation and assignments 5%
Practical Course 35%
Final Exam: 50% which include just theoretical

15. Student learning outcome:

Analytical chemistry plays a very role in the chemistry field, all student after graduate they working in some labs, industrial companies, hospitals and in all these institution they need principles of analytical chemistry and they use all assessment of data. For this reason analytical chemistry is exists in all four stages in our department. Now if we see all labs which are randomly distributed in our community all of them are depending on analysis the samples which came from different sources.

16. Course Reading List and References:

1- Analytical Chemistry by Gary D. Christain, 5th edition

2- Chemical Separation principles, Techniques and

Experiments by Clifton E. Meloan

3- Fundamentals of Analytical Chemistry by Douglas A. Skoog

4- Quantitative Chemical Analysis by Kolthofe- Sanell

5- Analytical Chemistry Principles by John H. Kennedy

6- Modern Analytical Chemistry by David Harvey

7- Analytical Chemistry, Theoretical and Metrological Fundamentals K. Danzer

8- Principles and Practice of Analytical Chemistry, F.W. Fifield

9- Validation and Qualification in Analytical Laboratories,

17. The Topics:	Lecturer's name
1. History of Statistical Chemistry 2. Terminology 3. Example	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week seventeen
1- Subsection of the analytical approach to problem solving 2- Classifying Analytical Techniques 3- Analytical Techniques 4- The Assessment of Analytical Data	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week eighteen
1- Definitions and Basic Concepts 2- Gaussian Distribution 3- Mean 4- Median 5- Mode 6- Deviation 7- Exercise	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week nineteen
1- Selecting an Analytical Method 2- Numerical Criteria for Selecting an Analytical Method 3- Precision 4- Methods for expressing precision 5- Absolute Method for Precision 6- Relative Methods for Precision 7- Absolute Standard deviation	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty

Topics	Instructor
1- Normal Distribution 2- Relative Standard Deviation 3- Coefficient of Variation 4- Variance 5- Spread 6- Standard Deviation of the Mean	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty one
1. The Nature and Origin of Errors 2. Types of Error 3. Determinate Error	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty two
Third Examination	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty three
1- Determinate of method errors 2- Indeterminate Error 3- Accuracy and Trueness 4- Accuracy Calculations 5- Model of Error	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty four
1- Probability of Obtaining a Specific Measured Value 2- Frequency of Measuring Specific Values 3- Accuracy, Precision, Resolution 4- Quantifying Accuracy, Precision, Resolution 5- Precision versus Accuracy	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty five
1- Calibration 2- Standardization of Analytical Methods 3- Calibration Curve 4- Typical Calibration Curve 5- Calibration Process 6- Characteristics 7- Objective 8- Summary of Process	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty six
Final Examination	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty seven
1- Calibration Curve 2- Sample Preparation 3- Standardization of Analytical Methods 4- Standard Addition	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty eight
1. Sensitivity 2. Calibration Sensitivity 3. Analytical Sensitivity	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week twenty nine
1- Reproducibility 2- Detection Limit	Assist Prof. Dr. Diyar S. Ali (2 hrs)

	Week Thirty one
3- Signal Detection Limit 4- Concentration Detection Limit 5- Limit of quantification 6- Selectivity	
1- Correlation Coefficients and Determinations 2- T and F-Tests 3- Examples and solving steps by steps	Assist Prof. Dr. Diyar S. Ali (2 hrs) Week Thirty two

18. Practical Topics (If there is any)

Class: Sunday 8:30 –11:00 / 11:00-1:30 / 1:30- 4:00 Practical

Monday 8:30 –11:00 / 11:00-1:30 / 1:30- 4:00 Practical

Course Objective

The following objectives should be achieved by the student during first course. All of the objectives are preceded by the phrase, "The student should be able to:" All Gravimetric and Statistical experiments for the course included

Grading

The students are required to do at least two closed exams for practical course besides other assignments. For every experiment the student must prepare full text paper which includes theory, calculation and discussion. All exams have 3 marks which meaning summation of it equal to 8 marks. 4 marks on the reports and seven marks on the quizzes.

Mid- course exam:

1st exam :8

2nd exam: 8

Classroom participation and assignments

Which distributed as follows?

Report: 4

Quiz: 7

Final Exam: 8 for practical and theoretical

Course Material

1. Analytical Chemistry by Gary D. Christain, 5th edition

2. Chemical Separation principles, Techniques and Experiments by Clifton E. Meloan

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4. Quantitative Chemical Analysis by Kolthofe- Sanell

5. Analytical Chemistry Principles by John H. Kennedy

6. Modern Analytical Chemistry by David Harvey

7. Analytical Chemistry, Theoretical and Metrological Fundamentals K. Danzer

8. Principles and Practice of Analytical Chemistry, F.W. Fifield

9. Validation and Qualification in Analytical Laboratories, Ludwig Huber

10. A Text Book of Quantitative Analysis; By: Vogel.

11. Quantitative Chemical Analysis; By: Kolthoff.

12. Quantitative Analysis; By: Alexeyev.

Course Program

Week 16:

Gravimetric determination Copper.

Week 17:

Gravimetric determination Copper (unknown).

Week 18:

Gravimetric determination of Bismuth.

Week 19:

Gravimetric determination of Bismuth (unknown).

Week 20:

Gravimetric determination of Lead (Pb)

Week 21:

Gravimetric determination of Lead (Pb) (unknown).

Week 22:

Gravimetric determination of Nickel

Week 23:

Gravimetric determination of Nickel (unknown).

Week 24:

Gravimetric determination of Molybdenum

Week 25:

Gravimetric determination of Molybdenum (unknown)

2nd Lab Examination

Week 26:

Gravimetric determination of Aluminium

Week 27:

Gravimetric determination of Aluminium (unknown)

Week 28:

Accuracy and Precision

Week 29:

Seminar

Week 30:

Seminar

19. Examinations:

1) Organic sample weighed 0.185 g was ignited in an excess of oxygen, then all carbon dioxide were collected in barium hydroxide solution. Calculate the percentage of carbon in the sample, if you know that the precipitate formed (barium carbonate) weighed 0.526 gm. What the name of this type of gravimetric analysis?