# Course Syllabus
## Faculty of Arts and Science
## Academic Department Chemistry
## Academic Year 2021/2022 Semester: Second

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| **Course Title :** | Instrumental Analysis 2 |
| **Course No. :** | 1722313 |
| **Prerequisite :** | 1722312 |
| **Concurrent :** | ……. |
| **Department :** | Chemistry |
| **Coordinator :** | Dr. Waed Alahmad |
| **Mode of Instruction** | **Blended Learning**<br>- 2 hours in-class (Synonym) learning<br>- 1 hour online asynchronous learning using Edu-Gate |

*** Instructor:**

| Lecturer | Office Phone | Room No. | Office Hours | E-mail |
|---|---|---|---|---|
| ***Dr. Waed Alahmad*** | 1414 | *221* | 9-10 ST<br>9.30-11 MW | *W_alahmad@asu.edu.jo* |

## Course Description

An introduction to the terminology and theory of chromatographic separations with an emphasis on optimization of experimental variables for efficient qualitative and quantitative analysis. Then a discussion of the theory and practice of gas chromatography. Liquid chromatography, the mainstay of analytical chromatography, describes the techniques of supercritical fluid chromatography and supercritical fluid extraction the emerging fields of capillary electrophoresis,
capillary electrochromatography, and field-flow fractionation. Applications of each method are included in the appropriate.

## Intended Learning Outcomes

Upon the completion of the course, this module should lead to the following learning outcomes:

### A. Knowledge and Understanding (Student should):

A1 Compare and contrast between different chromatography techniques.

A2 To Set up principles and to know the main concepts and requirements of instrumental analysis such as precision, accuracy, signal to noise ratio, limit of detection, sensitivity, selectivity, etc

A3 To introduce and illustrate the main concepts related to different chromatography techniques both qualitative and quantitative instruments.

### B. Cognitive and Intellectual Skills (Student should):

B1 To solve problems related to each type of instruments (quantitative analysis)

B2 Interpret the spectrum, chromatogram.

### C. Subject Specific Skills (Student should):

C1 Online Researching on different topics in different websites of the studied topics.

C2 Promote problem-solving skills

## Program Learning Outcomes (PLOs):

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|---|---|
| 1.1 | Describe the fundamentals of chemistry including structure, reactivity and properties of chemical substances, different situation of reaction and the states of matter. |
| 1.2 | Construct essential facts, principles and theories across the four principal areas of chemistry, i.e. analytical, organic, inorganic and physical. |
| 2.1 | Differentiate between the different states of the matter, elements and compounds based on the recognition and quantification of the properties |
| 2.2 | Explain concepts, principles and determine the efficiency of chemical systems by applying mathematical expressions |
| 2.3 | Analyze chemical and spectral data to identify and confirm chemical structures as well as determine chemical composition |
| 2.5 | Solve the scientific problems using different mechanisms and procedures |
| 3.1 | Demonstrate adequate life-long learning skills |
| 3.3 | Select appropriate techniques and procedures for chemical synthesis and analysis. |
| 4.3 | Interpret data derived from laboratory observations and measurements in terms of their significance and the theory underlying them. |
| 4.4 | Employ computational software's and data- processing skills in handling of chemical information and analysis of chemical data |

| Course Learning Outcomes Alignment Matrix | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PLO** | **A1** | **A2** | **A3** | **B1** | **B2** | **C1** | **C2** |
| 1.1 | √ | | | | | | |
| 1.2 | | √ | | | | | |
| 2.1 | | | √ | | | | |
| 2.2 | | | | | √ | | |
| 2.3 | | | | | √ | | |
| 2.5 | | | | √ | | | |
| 3.1 | | | | | | √ | |
| 3.3 | | | | | | √ | |
| 4.3 | | | | | √ | | √ |
| 4.4 | | | | | | | √ |

## Course Contents and Schedule

| No. | Day and Date | Topics to be covered | Method of instruction | CLOs | PLO |
|---|---|---|---|---|---|
| 1 | Sun. 6/3/2022<br>Tue. 8/3/2022<br>Thur. 10/3/2022 | 26A General Description of Chromatography 696<br>26B Migration Rates of Solutes 699<br>26C Band Broadening and Column Efficiency 702 | In-class lecture<br>In-class lecture | A1 | 1.1 |
| 2 | Sun. 13/3/2022<br>Tue. 15/3/2022<br>Thur. 17/3/2022 | 26D Optimization of Column Performance 708<br>26E Summary of Chromatographic Relationships 713 26F Applications of Chromatography 713 | In-class lecture<br>In-class lecture | A2 | 1.2 |
| 3 | Sun. 20/3/2022<br>Tue. 22/3/2022<br>Thur. 24/3/2022 | 27A Principles of GLC 720<br>27B Instruments for GLC 721<br>27C Gas Chromatographic Columns and Stationary Phases 731 | In-class lecture<br>In-class lecture | A2 | 1.2 |
| 4 | Sun. 27/3/2022<br>Tue. 29/3/2022<br>Thur. 31/3/2022 | 27D Applications of GC 736<br>27E Advances in GC 737<br>27F Gas-Solid Chromatography 740 | In-class lecture Quiz1<br>In-class lecture | A3 | 2.1 |
| 5 | Sun. 3/4/2022<br>Tue. 5/4/2022<br>Thur.7/4/2022 | 28A Scope of HPLC 747 28B Column Efficiency in LC 747<br>28C Instrumentation 749 28D Partition Chromatography 757 | In-class lecture<br>In-class lecture | A3 | 2.1 |
| 6 | Sun. 10/4/2022<br>Tue. 12/4/2022<br>Thur. 14/4/2022 | 28E Adsorption Chromatography 766<br>28F Ion Chromatography 766<br>28G Size-Exclusion Chromatography 771 | In-class lecture Assignment 1<br>In-class lecture | A2<br>B2 | 1.2<br>2.2 |
| 7 | Sun. 17/4/2022<br>Tue. 19/4/2022<br>Thur. 21/4/2022 | 28H Affinity Chromatography 774 28I Thin-Layer Chromatography 775 | In-class lecture<br>In-class lecture | B2 | 2.3<br>4.3 |
| 8. | Midterm Exam | | | | |

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|---|---|---|---|---|---|
| 9 | Sun. 1/5/2022<br>Tue. 3/5/2022<br>Thur. 5/5/2022 | 29A Properties of Supercritical Fluids 782<br>29B Supercritical Fluid Chromatography 783 | In-class lecture<br>Online sessions (asynchronous) | **B1** | **2.5** |
| 10 | Sun. 8/5/2022<br>Tue. 10/5/2022<br>Thur. 12/5/2022 | 29C Supercritical Fluid Extraction 789 | In-class lecture<br>Quiz 2<br>Online sessions (asynchronous) | **B2** | **2.3**<br>**4.3** |
| 11 | Sun. 15/5/2022<br>Tue. 17/5/2022<br>Thur. 19/5/2022 | 30A An Overview of Electrophoresis 793<br>30B Capillary Electrophoresis 794 | In-class lecture<br>Online sessions (asynchronous) | **B2** | **2.3**<br>**4.3** |
| 12 | Sun. 22/5/2022<br>Tue. 24/5/2022<br>Thur. 26/5/2022 | 30C Applications of CE 800<br>30D Packed Column Electrochromatography 808 | In-class lecture<br>Online sessions (asynchronous) | **C2** | **4.3** |
| 13 | Sun. 29/5/2022<br>Tue. 31/5/2022<br>Thur. 2/6/2022 | 30E Field-Flow Fractionation 808 | In-class lecture<br>Assignment 2 | **C2** | **4.4** |
| 14 | Sun. 5/6/2022<br>Tue. 7/6/2022<br>Thur. 9/6/2022 | Instrumental Analysis in Action— The Bisphenol A Controversy 815 | Online sessions (asynchronous)<br>In-class lecture<br>Online sessions (asynchronous) | **C1** | **3.1** |
| 15 | Sun. 12/6/2022<br>Tue. 14/6/2022<br>Thur. 16/6/2022 | Instrumental Analysis in Action— The Bisphenol A Controversy 815 | Assignment 3<br>Online sessions (asynchronous)<br>Online sessions (asynchronous) | **C1** | **3.3** |
| 16. | **Final Exam** | | | | |

## Grading Plan and Assessment Tools

| Assessment Tools | Weights | Due date |
|---|---|---|
| Mid-term | 30 | TBA |
| Assignments | 15 | TBA |
| Quizzes | 15 | TBA |
| Inter active lectures | …… | |
| Group Work | …… | |
| Presentation | …… | |
| Reports | …… | |
| Project | …… | |
| Case-Study | …… | |
| Final Exam | 40 | TBA |

## Supplementary Reading

Textbook:

- Douglas A. Skoog, F James Holler and Stanley Crouch (2007) Principles of Instrumental Analysis. 6th Edition or later.

**References:**

- Contemporary instrumental analysis / by: Rubinson, Kenneth A. Published: (2000)
- Chemical instrumentation: a systematic approach / by: Strobel, Howard A. Published: (1989)

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|---|---|---|---|
| **Subject Coordinator** | **Dr. Waed Alahmad** | **Signature:** | ---------- |
| **Head of Curriculum Committee** | **Dr. Hussam Miqdad** | **Signature:** | ---------- |
| **Department Head** | **Dr. Hussam Miqdad** | **Signature:** | ---------- |
| **Faculty Dean** | **Dr. Hadeel Ali Saed** | **Signature:** | ---------- |

**Copy to:**

- Department Head.
- Head of Curriculum Committee.
- Course File.