



## Course Specification of Pharmaceutical Instrumental Analysis II

I. Course Identification and General Information:					
1	<b>Course Title</b>	Pharmaceutical Instrumental Analysis II			
2	<b>Course Number &amp; Code:</b>	Ph5710			
3	<b>Credit hours:</b>	<b>C.H</b>			
		<b>Th.</b>	<b>Pr.</b>	<b>Tr.</b>	<b>Seminar.</b>
		2	2		
3		<b>Total</b>			
4	<b>Study level/ semester at which this course is offered:</b>	4 <sup>th</sup> level / 1 <sup>st</sup> semester			
5	<b>Pre –requisite (if any):</b>	Pharmaceutical Analytical Chemistry I & II and Pharmaceutical Instrumental Analysis I			
6	<b>Co –requisite (if any):</b>				
7	<b>Program (s) in which the course is offered:</b>	Bachelor of Pharmacy			
8	<b>Language of teaching the course:</b>	English			
9	<b>The department in which the course is offered:</b>	Department of Medicinal Chemistry, Pharmaceutical Organic and Analytical Chemistry			
10	<b>Location of teaching the course:</b>	Faculty of Pharmacy			
11	<b>Prepared by:</b>	Dr. Yahya AL-Dokhain, Dr. Mohammed Hamidaddin			
12	<b>Date of approval:</b>				
II. Course description:					
The course is concerned with the fundamental knowledge about the basic principles of some instrumental methods of analysis including, electrochemical, chromatographic, immunoassay and electrophoresis. The course will also cover the applications of these methods for some pharmaceutical substances.					



### III. Intended learning outcomes (ILOs) of the course:

**At the end of this course the students should be able to:**

1. Mention the basic principle of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.
2. Explain the advantages and disadvantages of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.
3. Recognize the pharmaceutical applications of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis
4. Select the appropriate methods of analysis for different pharmaceutical substances and pharmaceutical preparations.
5. Develop new methods for analysis of pharmaceutical substances and pharmaceutical preparations.
6. Interpret and analyze the results of methods of analysis.
7. Operate different pharmaceutical instruments and equipments in the lab.
8. Handle and dispose the chemical and pharmaceutical preparations safely and effectively.
9. Practice immunoassay, electrophoresis, electrochemical and chromatographic methods for analysis of pharmaceutical substances and pharmaceutical preparations.
10. Communicate and cooperate effectively with the others as a team work to perform the report on the results of the method of analysis.
11. Apply the information technology skills, such as word processing and internet communication and online searches.
12. Manage the time in work effectively.

### IV. Intended learning outcomes (ILOs) of the course:

#### (A) Knowledge and Understanding:

Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in:  
**Knowledge and Understanding.**

Program Intended Learning Outcomes (Sub-PILOs) in: <b>Knowledge and Understanding</b>		Course Intended Learning Outcomes (CILOs) in: <b>Knowledge and Understanding</b>	
After completing this program, students would be able to:		After participating in the course, students would be able to:	
<b>A1-</b>	Recognize the principles of physical, chemical, clinical, social, behavioral, health and pharmaceutical sciences.	<b>a1-</b>	Mention the basic principle of immunoassay, electrophoresis,



			electrochemical and chromatographic methods of analysis.
A2-	Recognize the physicochemical properties, preparation, structure activity relationship (SAR), toxicity and the modern methods of analysis of various substances of chemical and natural products of therapeutic potential as well as the basic principle of drug discovery, design and development	a2-	Explain the advantages and disadvantages of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.
		a3-	Recognize the pharmaceutical applications of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.

### Teaching And Assessment Methods For Achieving Learning Outcomes:

#### Alignment Learning Outcomes of Knowledge and Understanding to Teaching and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in Knowledge and Understanding After participating in the course, students would be able to:		Teaching strategies/methods to be used	Methods of assessment
a1-	Mention the basic principle of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.	Lectures method, group discussion and tutorial	Oral Exam, homework, report, Quizzes, Short answers and Written exam
a2-	Explain the advantages and disadvantages of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.		
a3-	Recognize the pharmaceutical applications of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.		

### (B) Intellectual Skills:

#### Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: Intellectual skills

Program Intended Learning Outcomes (Sub-PILOs) in Intellectual skills	Course Intended Learning Outcomes (CILOs) of Intellectual Skills
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رئيس الجامعة  
إ.د. القاسم محمد عباس

مركز التطوير الأكاديمي وضمان الجودة  
إ.د. هدى العماد

عميد الكلية  
إ.د. خالد الشويه

وحدة ضمان الجودة  
إ.د. محمود البريهي



After completing this program, students would be able to:		After participating in the course, students would be able to:	
<b>B1-</b>	Consolidate the chemical, biochemical and physiological principles to construct the pharmacophores of the structure and their effect on the stability, pharmacokinetic and pharmacodynamic profiles of the drug.	<b>b1-</b>	Select the appropriate methods of analysis for different pharmaceutical substances and pharmaceutical preparations.
<b>B3-</b>	Design different types of safe and effective pharmaceutical dosage forms and develop novel methods of qualitative and quantitative analytical and biological analysis for pharmaceutical and biopharmaceutical products that support pharmaceutical research.	<b>b2-</b>	Develop new methods for analysis of pharmaceutical substances and pharmaceutical preparations.
		<b>b3-</b>	Interpret and analyze the results of methods of analysis

### Teaching And Assessment Methods For Achieving Learning Outcomes:

#### Alignment Learning Outcomes of Intellectual Skills to Teaching Methods and Assessment Methods:

<i>Course Intended Learning Outcomes (CILOs) in Intellectual Skills.</i>		<i>Teaching strategies/methods to be used.</i>	<i>Methods of assessment</i>
After participating in the course, students would be able to:			
<b>b1-</b>	Select the appropriate methods of analysis for different pharmaceutical substances and pharmaceutical preparations.	Lectures method, group discussion and tutorial	Oral Exam, homework, report, Quizzes, Short answers and Written exam
<b>b2-</b>	Develop new methods for analysis of pharmaceutical substances and pharmaceutical preparations.		
<b>b3-</b>	Interpret and analyze the results of methods of analysis		

### (C) Professional and Practical Skills.

#### Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: Professional and Practical Skills



Program Intended Learning Outcomes (Sub- PILOs) in Professional and Practical Skills		Course Intended Learning Outcomes (CILOs) in Professional and Practical Skills	
After completing this program, students would be able to:		After participating in the course, students would be able to:	
C1-	Operate different pharmaceutical equipments and instruments and use emerging technologies in design, synthesis, pre-formulation, formulation, packaging, storage and analysis of pharmaceutical products according to GLP, GSP and cGMP guidelines.	c1-	Operate different pharmaceutical instruments and equipments in the lab.
C2-	Handle and dispose chemicals and pharmaceutical preparations safely and effectively.	c2-	Handle and dispose the chemical and pharmaceutical preparations safely and effectively.
C3-	Extract, isolate, purify, identify and formulate the natural products and assure their rational use.	c3-	Practice immunoassay, electrophoresis, electrochemical and chromatographic methods for analysis of pharmaceutical substances and pharmaceutical preparations.
C5-	Conduct research studies and utilize the results in different pharmaceutical fields.		

### Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment Learning Outcomes of Professional and Practical Skills to Teaching and Assessment Methods:

Course Intended Learning Outcomes (CILOs) in Professional and Practical Skills		Teaching strategies/methods to be used	Methods of assessment
After participating in the course, students would be able to:			
c1-	Operate different pharmaceutical instruments and equipments in the lab.	Lectures method, group discussion and practical sessions	Oral Exam, homework, report, Quizzes, and Written exam
c2-	Handle and dispose the chemical and pharmaceutical preparations safely and effectively.		
c3-	Practice immunoassay, electrophoresis, electrochemical and chromatographic methods for analysis of pharmaceutical substances and pharmaceutical preparations.		

### (D) General / Transferable Skills:



Alignment Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs) in: <b>General and Transferable skills</b>			
Program Intended Learning Outcomes (PILOs) in General / Transferable skills		Course Intended Learning Outcomes (CILOs) in General / Transferable skills	
After completing this program, students would be able to:		After participating in the course, students would be able to:	
D2-	Employ proper documentation and filing systems in different pharmaceutical fields	d1-	Communicate and cooperate effectively with the others as a team work to perform the report on the results of an analytical method.
D5-	Apply information and communication technology and working effectively in a team.	d2-	Manage the time in work effectively.
		d3-	Apply the information technology skills, such as word processing and internet communication and online searches.

### Teaching And Assessment Methods For Achieving Learning Outcomes:

Alignment Learning Outcomes of General and Transferable skills to Teaching and Assessment Methods.			
Course Intended Learning Outcomes (CILOs) in General and Transferable Skills		Teaching strategies/methods to be used.	Methods of assessment
After participating in the course, students would be able to:			
d1-	Communicate and cooperate effectively with the others as a team work to perform the report on the results of an analytical method.	Lectures method, group discussion and practical sessions	Oral Exam, homework, report, Quizzes, Short answers and Written exam
d2-	Manage the time in work effectively.		
d3-	Apply the information technology skills, such as word processing and internet communication and online searches.		

## V. Course Content:

### 1 – Course Topics/Items:





### a – Theoretical Aspect

Order	Topic List / Units	CILOs (symbols)	Sub-topic List	Number of weeks	Contact hours
1.	Electrochemical methods	a1-3, b1-3, d1-3	<b>Electrochemical methods</b> <b>1.Potentiometry</b> Definition, principles, instrumentation, pharmaceutical applications <b>2.Polarography:</b> Definition, principles, instrumentation, pharmaceutical applications <b>2.Conductometry:</b> Definition, principles, instrumentation, pharmaceutical applications <b>3.Voltammetry:</b> Definition, principles, instrumentation, pharmaceutical applications	3	6
2.	Introduction to Chromatography	a1-3, b1-3, d1-3	- Introduction, Definitions ,classifications principles -Theory of column efficiency	1	2
3.	Thin layer chromatography	a1-3, b1-3, d1-3	Definition, principles, stationary phase, mobile phases, sample application, elution, detection, quantitative measurement and pharmaceutical applications	1	2
4.	Column, Ion exchange and Size Exclusion Chromatography	a1-3, b1-3, d1-3	Definition, principles, instrumentation, pharmaceutical applications	1	2
5.	Mid Exam	a1-3, b1-3		1	2
6.	High performance liquid Chromatography (HPLC)	a1-3, b1-3, d1-3	Definition, principles, classification, instrumentation, stationary phase, mobile phases, detectors, pharmaceutical applications	2	4
7.	Gas Chromatography	a1-3, b1-3, d1-3	Definition, principles, stationary phase, mobile phases, derivatization of sample, temperature selection, pharmaceutical applications	2	4



8.	<b>Immunoassay method for analysis</b>	a1-3, b1-3, d1-3	Definition, principles, instrumentation, pharmaceutical applications	2	4
9.	<b>Electrophoresis</b>	a1-3, b1-3, d1-3	Definition, principles, types, instrumentation, pharmaceutical applications	1	2
10.	<b>Final Exam</b>	a1-3, b1-3		1	2
<b>Number of Weeks /and Units Per Semester</b>				<b>16</b>	<b>32</b>

<b>b - Practical Aspect</b>				
<b>Order</b>	<b>Tasks/ Experiments</b>	<b>CILOs (symbols)</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>
1)	Potentiometric determination of chlorides in natural water	c1,c2, c3, <b>d1-3</b>	1	2
2)	<b>Conductometric determination of water sample</b>	c1,c2, c3, <b>d1-3</b>	1	2
3)	<b>Voltammetric determination of ciprofloxacin</b>	c1,c2, c3, <b>d1-3</b>	1	2
4)	<b>Determination the R<sub>f</sub> of some pharmaceutical substances.</b>	c1,c2, c3, <b>d1-3</b>	2	4
5)	Paper chromatographic determination of ephedrine HCl	c1,c2, c3, <b>d1-3</b>	1	2
6)	TL chromatographic determination of ephedrine HCl	c1,c2, c3, <b>d1-3</b>	1	2
7)	Mid-Exam	c1,c2, c3	1	2
8)	<b>Separation of mixture of pharmaceutical substances using chromatographic technique</b>	c1,c2, c3, <b>d1-3</b>	2	4
9)	Immunoassay method for analysis <b>of amikacin in biological fluids</b>	c1,c2, c3, <b>d1-3</b>	1	2
10)	Immunoassay method for analysis <b>of gentamycin in biological fluids</b>	c1,c2, c3, <b>d1-3</b>	1	2
11)	Immunoassay method for analysis <b>of cyclosporins in biological fluids</b>	c1,c2, c3, <b>d1-3</b>	1	2





12)	Practice electrophoresis method for some pharmaceutical substances	c1,c2, c3, d1-3	1	2
13)	Review	c1,c2, c3, d1-3	1	2
14)	Final Exam	c1-3	1	2
Number of Weeks /and Units Per Semester			16	32

#### VI. Teaching strategies of the course:

Lectures method, Discussions, Small group discussions, Tutorials and Practice session.

#### VII. Assignments:

- Homework
- Reports

#### VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes (CILOs symbols)
1	Attendance, Participation, reports and quizzes	All Weeks	10	7%	a1, b1,b2, d1-3
2	Oral Tests and Homework-assignments	Sporadic through the semester	10	7%	a2, a3, b1, b3, d1-3
3	Attendance, Practical Reports and Practical mid-semester exam	8 <sup>th</sup>	30	20%	c1-3
5	Theoretical mid-semester exam	7 <sup>th</sup>	30	20%	a1-3, b1, b2, b3
6	Final Exam (theoretical)	16 <sup>th</sup>	50	33%	a1-3, b1, b2, b3



7	Final Exam (practical)	16 <sup>th</sup>	20	13%	c1-3
Total			150	100%	

### IX. Students' Support:

Office Hours/week	Other Procedures (if any)
Two contact hours per week	None

### X. Learning Resources:

#### 1- Required Textbook(s) ( maximum two ).

- 1- Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch. 2004. Fundamentals of Analytical Chemistry,,8<sup>th</sup> edition ,Thomson Brooks/Cole, Belmont, USA.
- 2- G H Jeffery, J Bassatt, J Mendham, R C Denny, 1979.Vogel's Textbook of qualitative chemical analysis, 5<sup>th</sup> edition, Longman group UK Limited, London, England.
- 3-F.W. Fifield and D. Kealey, 2000, "Principles and Practice of Analytical Chemistry" 5<sup>th</sup> Edition Blackwell Science, London.

#### 2- Recommended Books and Reference Materials.

- 1- DEAN'S , 2004. Analytical Chemistry Handbook, 2<sup>nd</sup> edition, McGraw-Hill Handbooks, New York, USA .
- 2- Gary, D.C, 1986., Analytical Chemistry, 4th ed. John Wiley and Sons, New York.
- 3- Somenath Mitra, 2003. Sample Preparation Techniques in Analytical Chemistry, A John Wiley & Sons, Inc., Publication,Canada.
- 4- K. Danzer, 2007. Analytical Chemistry Theoretical and Metrological Fundamentals, ,Springer-Verlag Berlin Heidelberg.
- 5- Lectures Notes and Practical Manual.

#### 3- Electronic Materials and Web Sites etc.



<ol style="list-style-type: none"> <li>1. Talanta.</li> <li>2. Plos1</li> <li>3. The Analyst;</li> <li>4. J. Pharm. &amp; Biomed. Anal.</li> <li>5. J. Assoc. off Anal. Chem.</li> <li>6. The Analytical Abstracts database (<a href="http://www.rsc.org/CFAA/AASearchPage.cfm">http://www.rsc.org/CFAA/AASearchPage.cfm</a>)</li> <li>7. The Analytical Forum on ChemWeb (<a href="http://analytical.chemweb.com/search/search.exe">http://analytical.chemweb.com/search/search.exe</a>)</li> <li>8. chemweb.com/search/search.exe)</li> </ol>
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I. Facilities Required:	
<b>1 - Accommodation:</b>	<ul style="list-style-type: none"> <li>- Well-equipped lecture halls with data show facilities, whiteboards, net connection, etc.</li> <li>- Well-equipped laboratories with all required equipment and reagents.</li> </ul>
<b>2 - Computing resources:</b>	<ul style="list-style-type: none"> <li>- Computer laboratory with internet facilities.</li> </ul>
II. Course Improvement Processes:	
1- Strategies for obtaining student feedback on effectiveness of teaching	
	<ul style="list-style-type: none"> <li>▪ Student-based assessment of the effectiveness of teaching using a questionnaire designed by the Quality Assurance Unit at the end of the semester.</li> <li>▪ Meeting with students and faculty (once per semester).</li> </ul>
2- Other strategies for evaluation of teaching by the instructor or by the department.	
	<ul style="list-style-type: none"> <li>▪ Assessment of the course syllabus and contents by the teachers using a questionnaire designed by the Quality Assurance Unit of the university at the end of the semester.</li> <li>▪ Regular meeting and discussion of the course content between the Head of Department and the teaching staff of the course (for theory and practice).</li> </ul>
3- Processes for improvement of teaching.	
	<ul style="list-style-type: none"> <li>▪ Revision of the course specification and its teaching strategies every three academic years after consideration of all issues raised by the teachers and/or students during regular meetings and discussions.</li> </ul>



	<ul style="list-style-type: none"> <li>Exploring any possible defects in the course that might be encountered by the teaching staff and their mitigation in subsequent improved versions of course specification.</li> </ul>
<b>4- Processes for verifying standards of students' achievement</b>	
	<ul style="list-style-type: none"> <li>Checking of a sample of students' work by an independent faculty member.</li> <li>Periodic exchange and check marking of a sample of students' assignments with a faculty member from another institution.</li> <li>Adoption of scoring rubrics to assess the students' achievement (both for ongoing or summative assessments).</li> <li>Regular follow-up of laboratory logbooks to assess the practical achievement of students.</li> </ul>
<b>5- Procedures for periodically reviewing of course effectiveness and planning for improvement</b>	
	<ul style="list-style-type: none"> <li>Student rating and feedback</li> <li>Peer rating and feedback</li> <li>Regular meeting of the Curriculum Committee of the faculty.</li> </ul>
<b>6- Course Development Plans</b>	
	<ul style="list-style-type: none"> <li>Conducting regular workshops for the staff for improving their course specification skills.</li> <li>Regular revision of course specification and syllabus items.</li> </ul>

### VIII. Course Policies: (including plagiarism, academic honesty, attendance etc)

The University Regulations on academic misconduct will be strictly enforced. Please refer to -----

<b>1</b>	<p><b>Class Attendance:</b></p> <ul style="list-style-type: none"> <li>Attendance of all lectures and practical sessions is required. Unexcused absence exceeding 25% of the lectures or practical sessions will disqualify the student from entering the final exam.</li> </ul>
<b>2</b>	<p><b>Tardy:</b></p> <p>- Roll will be called in the very beginning of each lecture and practical class. Retardation for more than three weeks without a reasonable excursion, the student involved shall not be allowed to attend the class any longer and consequently shall be considered to be absent.</p>



3	<b>Exam Attendance/Punctuality:</b> <ul style="list-style-type: none"><li>Exam attendance is obligatory unless being excused by the department and faculty.</li><li>Absence from assignments or exams will be dealt with according to the general policy of the university.</li></ul>
4	<b>Assignments &amp; Projects:</b> <ul style="list-style-type: none"><li>Assignments: Written and oral; Laboratory logbook signed by the responsible demonstrator.</li><li>Projects: Not applicable.</li></ul>
5	<b>Cheating:</b> <ul style="list-style-type: none"><li>Punishment of cheating will be according to the general policy of the university in this respect.</li></ul>
6	<b>Plagiarism:</b> <ul style="list-style-type: none"><li>Plagiarism in written essays, reports, etc. is not accepted, and students who plagiarize the works of others will be punished according to the general policy of the university.</li></ul>
7	<b>Other policies:</b> <ul style="list-style-type: none"><li>General policies of the Students' Affairs of the University and the Quality Assurance Unit.</li></ul>



## Course Plan of Pharmaceutical Instrumental Analysis II

I- Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	Dr. Yahya AL-Dokhain, Dr. Mohammed Hamid- Addeen		Office Hours				
Location & Telephone No.		SAT	SUN	MON	TUE	WED	THU
E-mail							

II- Course Identification and General Information:					
1-	Course Title:	Pharmaceutical Instrumental Analysis II			
2-	Course Number & Code:	Ph5710			
3-	Credit hours:	C.H			Total
		Th.	Seminar	Pr.	
		2	-	2	3
4-	Study level/year at which this course is offered:	4 <sup>th</sup> level /1 <sup>st</sup> semester			
5-	Pre –requisite (if any):	Pharmaceutical analytical chemistry I&II and Pharmaceutical Instrumental Analysis I			
6-	Co –requisite (if any):	-			





7-	Program (s) in which the course is offered	Bachelor of Pharmacy
8-	Language of teaching the course:	English
9-	System of Study:	Semesters
10-	Mode of delivery:	Regular
11-	Location of teaching the course:	Faculty of Pharmacy- Sana`a university

### III- Course description:

The course is concerned with the fundamental knowledge about the basic principles of some instrumental methods of analysis including, electrochemical, chromatographic, immunoassay and electrophoresis. The course will also cover the applications of these methods for some pharmaceutical substances.

### IV- Intended learning outcomes (ILOs) of the course:



**At the end of this course the students should be able to:**

13. Mention the basic principle of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.
14. Explain the advantages and disadvantages of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis.
15. Recognize the pharmaceutical applications of immunoassay, electrophoresis, electrochemical and chromatographic methods of analysis
16. Select the appropriate methods of analysis for different pharmaceutical substances and pharmaceutical preparations.
17. Develop new methods for analysis of pharmaceutical substances and pharmaceutical preparations.
18. Interpret and analyze the results of methods of analysis.
19. Operate different pharmaceutical instruments and equipments in the lab.
20. Handle and dispose the chemical and pharmaceutical preparations safely and effectively.
21. Practice immunoassay, electrophoresis, electrochemical and chromatographic methods for analysis of pharmaceutical substances and pharmaceutical preparations.
22. Communicate and cooperate effectively with the others as a team work to perform the report on the results of the method of analysis.
23. Apply the information technology skills, such as word processing and internet communication and online searches.
24. Manage the time in work effectively.

## V- Course Content:

### 1 – Course Topics/Items:

#### a – Theoretical Aspect

Order	Topic List / Units	CILOs (symbols)	Sub-topic List	Week Due	Contact hours
11.	Electrochemical methods	a1-3, b1-3, d1-3	<u>Electrochemical methods</u> <b>1.Potentiometry</b> Definition, principles, instrumentation, pharmaceutical applications <b>2.Polarography:</b> Definition, principles, instrumentation, pharmaceutical applications	1-3	6



			<b>2. Conductometry:</b> Definition, principles, instrumentation, pharmaceutical applications <b>3. Voltammetry:</b> Definition, principles, instrumentation, pharmaceutical applications		
12.	Introduction to Chromatography	a1-3, b1-3, d1-3	- Introduction, Definitions ,classifications principles -Theory of column efficiency	4	2
13.	Thin layer chromatography	a1-3, b1-3, d1-3	Definition, principles, stationary phase, mobile phases, sample application, elution, detection, quantitative measurement and pharmaceutical applications	5	2
14.	Column, Ion exchange and Size Exclusion Chromatography	a1-3, b1-3, d1-3	Definition, principles, instrumentation, pharmaceutical applications	6	2
15.	Mid Exam	a1-3, b1-3		7	2
16.	High performance liquid Chromatography (HPLC)	a1-3, b1-3, d1-3	Definition, principles, classification, instrumentation, stationary phase, mobile phases, detectors, pharmaceutical applications	8,9	4
17.	Gas Chromatography	a1-3, b1-3, d1-3	Definition, principles, stationary phase, mobile phases, derivatization of sample, temperature selection, pharmaceutical applications	10,11	4
18.	Immunoassay method for analysis	a1-3, b1-3, d1-3	Definition, principles, instrumentation, pharmaceutical applications	12,13	4
19.	Electrophoresis	a1-3, b1-3, d1-3	Definition, principles, types, instrumentation, pharmaceutical applications	14,15	4
20.	Final Exam	a1-3, b1-3		16	2
<b>Number of Weeks /and Units Per Semester</b>				<b>16</b>	<b>32</b>

### b - Practical Aspect

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مركز التطوير الأكاديمي وضمان الجودة  
إ.د. هدى العماد

عميد الكلية  
إ.د. خالد الشويه

وحدة ضمان الجودة  
إ.د. محمود البريهي



Order	Tasks/ Experiments	CILOs (symbols)	Week Due	Contact Hours
15)	Potentiometric determination of chlorides in natural water	c1,c2, c3, d1-3	1	2
16)	<b>Conductometric determination of water sample</b>	c1,c2, c3, d1-3	2	2
17)	<b>Voltammetric determination of ciprofloxacin</b>	c1,c2, c3, d1-3	3	2
18)	<b>Determination the R<sub>f</sub> of some pharmaceutical substances.</b>	c1,c2, c3, d1-3	4,5	4
19)	Paper chromatographic determination of ephedrine HCl	c1,c2, c3, d1-3	6	2
20)	TL chromatographic determination of ephedrine HCl	c1,c2, c3, d1-3	7	2
21)	Mid-Exam	c1,c2, c3	8	2
22)	<b>Separation of mixture of pharmaceutical substances using chromatographic technique</b>	c1,c2, c3, d1-3	9,10	4
23)	<b>Immunoassay method for analysis of amikacin in biological fluids</b>	c1,c2, c3, d1-3	11	2
24)	<b>Immunoassay method for analysis of gentamycin in biological fluids</b>	c1,c2, c3, d1-3	12	2
25)	<b>Immunoassay method for analysis of cyclosporins in biological fluids</b>	c1,c2, c3, d1-3	13	2
26)	Practice electrophoresis method for some pharmaceutical substances	c1,c2, c3, d1-3	14	2
27)	<b>Review</b>	c1,c2, c3, d1-3	15	2
28)	Final Exam	c1-3	16	2
<b>Number of Weeks /and Units Per Semester</b>			<b>16</b>	<b>32</b>

## VI- Teaching strategies of the course:



Lectures method, Discussions, Small group discussions, Tutorials and Practice session.

### VII- Assignments:

- Homework
- Reports

### VIII-Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes (CILOs symbols)
1	Attendance, Participation, reports and quizzes	All Weeks	10	7%	a1, b1,b2, d1-3
2	Oral Tests and Homework-assignments	Sporadic through the semester	10	7%	a2, a3, b1, b3, d1-3
3	Attendance, Practical Reports and Practical mid-semester exam	8 <sup>th</sup>	30	20%	c1-3
5	Theoretical mid-semester exam	7 <sup>th</sup>	30	20%	a1-3, b1, b2, b3
6	Final Exam (theoretical)	16 <sup>th</sup>	50	33%	a1-3, b1, b2, b3
7	Final Exam (practical)	16 <sup>th</sup>	20	13%	c1-3
<b>Total</b>			<b>150</b>	<b>100%</b>	

### IX- Students' Support:

Office Hours/week	Other Procedures (if any)
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Two contact hours per week	None
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## X- Learning Resources:

### 1- Required Textbook(s) ( maximum two ).

- 3- Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch. 2004. Fundamentals of Analytical Chemistry,,8<sup>th</sup> edition ,Thomson Brooks/Cole, Belmont, USA.
- 4- G H Jeffery, J Bassatt, J Mendham, R C Denny, 1979.Vogel's Textbook of qualitative chemical analysis, 5<sup>th</sup> edition, Longman group UK Limited, London, England.
- 3-F.W. Fifield and D. Kealey, 2000, "Principles and Practice of Analytical Chemistry" 5<sup>th</sup> Edition Blackwell Science, London.

### 2- Recommended Books and Reference Materials.

- 6- DEAN'S , 2004. Analytical Chemistry Handbook, 2<sup>nd</sup> edition, McGraw-Hill Handbooks, New York, USA .
- 7- Gary, D.C, 1986., Analytical Chemistry, 4th ed. John Wiley and Sons, New York.
- 8- Somenath Mitra, 2003. Sample Preparation Techniques in Analytical Chemistry, A John Wiley & Sons, Inc., Publication,Canada.
- 9- K. Danzer, 2007. Analytical Chemistry Theoretical and Metrological Fundamentals, Springer-Verlag Berlin Heidelberg.
- 10- Lectures Notes and Practical Manual.

### 3- Electronic Materials and Web Sites etc.

9. Talanta.
10. Plos1
11. The Analyst;
12. J. Pharm. & Biomed. Anal.
13. J. Assoc. off Anal. Chem.
14. The Analytical Abstracts database (<http://www.rsc.org/CFAA/AASearchPage.cfm>)
15. The Analytical Forum on ChemWeb (<http://analytical.chemweb.com/search/search.exe>)





III. Facilities Required:	
<b>1 - Accommodation:</b>	<ul style="list-style-type: none"> <li>- Well-equipped lecture halls with data show facilities, whiteboards, net connection, etc.</li> <li>- Well-equipped laboratories with all required equipment and reagents.</li> </ul>
<b>3 - Computing resources:</b>	<ul style="list-style-type: none"> <li>- Computer laboratory with internet facilities.</li> </ul>
IV. Course Improvement Processes:	
6- Strategies for obtaining student feedback on effectiveness of teaching	
	<ul style="list-style-type: none"> <li>▪ Student-based assessment of the effectiveness of teaching using a questionnaire designed by the Quality Assurance Unit at the end of the semester.</li> <li>▪ Meeting with students and faculty (once per semester).</li> </ul>
7- Other strategies for evaluation of teaching by the instructor or by the department.	
	<ul style="list-style-type: none"> <li>▪ Assessment of the course syllabus and contents by the teachers using a questionnaire designed by the Quality Assurance Unit of the university at the end of the semester.</li> <li>▪ Regular meeting and discussion of the course content between the Head of Department and the teaching staff of the course (for theory and practice).</li> </ul>
8- Processes for Improvement of Teaching.	
	<ul style="list-style-type: none"> <li>▪ Revision of the course specification and its teaching strategies every three academic years after consideration of all issues raised by the teachers and/or students during regular meetings and discussions.</li> <li>▪ Exploring any possible defects in the course that might be encountered by the teaching staff and their mitigation in subsequent improved versions of course specification.</li> </ul>
9- Processes for Verifying Standards of Students' Achievement	
	<ul style="list-style-type: none"> <li>▪ Checking of a sample of students' work by an independent faculty member.</li> <li>▪ Periodic exchange and check marking of a sample of students' assignments with a faculty member from another institution.</li> </ul>



	<ul style="list-style-type: none"> <li>Adoption of scoring rubrics to assess the students' achievement (both for ongoing or summative assessments).</li> <li>Regular follow-up of laboratory logbooks to assess the practical achievement of students.</li> </ul>
<b>10- Procedures for Periodically Reviewing of Course Effectiveness and Planning for Improvement</b>	
	<ul style="list-style-type: none"> <li>Student rating and feedback</li> <li>Peer rating and feedback</li> <li>Regular meeting of the Curriculum Committee of the faculty.</li> </ul>
<b>6- Course Development Plans</b>	
	<ul style="list-style-type: none"> <li>Conducting regular workshops for the staff for improving their course specification skills.</li> <li>Regular revision of course specification and syllabus items.</li> </ul>

<b>IX. Course Policies: (including plagiarism, academic honesty, attendance etc)</b>	
<b>The University Regulations on academic misconduct will be strictly enforced. Please refer to -----</b>	
<b>1</b>	<b>Class Attendance:</b> <ul style="list-style-type: none"> <li>Attendance of all lectures and practical sessions is required. Unexcused absence exceeding 25% of the lectures or practical sessions will disqualify the student from entering the final exam.</li> </ul>
<b>2</b>	<b>Tardy:</b> <ul style="list-style-type: none"> <li>Roll will be called in the very beginning of each lecture and practical class. Retardation for more than three weeks without a reasonable excursion, the student involved shall not be allowed to attend the class any longer and consequently shall be considered to be absent.</li> </ul>
<b>3</b>	<b>Exam Attendance/Punctuality:</b> <ul style="list-style-type: none"> <li>Exam attendance is obligatory unless being excused by the department and faculty.</li> <li>Absence from assignments or exams will be dealt with according to the general policy of the university.</li> </ul>
<b>4</b>	<b>Assignments &amp; Projects:</b> <ul style="list-style-type: none"> <li>Assignments: Written and oral; Laboratory logbook signed by the responsible demonstrator.</li> <li>Projects: Not applicable.</li> </ul>
<b>5</b>	<b>Cheating:</b>



	<ul style="list-style-type: none"><li>Punishment of cheating will be according to the general policy of the university in this respect.</li></ul>
6	<b>Plagiarism:</b> <ul style="list-style-type: none"><li>Plagiarism in written essays, reports, etc. is not accepted, and students who plagiarize the works of others will be punished according to the general policy of the university.</li></ul>
7	<b>Other policies:</b> <ul style="list-style-type: none"><li>General policies of the Students' Affairs of the University and the Quality Assurance Unit.</li></ul>

Republic of Yemen  
Ministry of Higher  
Education and Scientific  
Research  
Sana'a University  
Faculty of Pharmacy  
Quality Assurance Unit



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جامعة - صنعاء  
كلية الصيدلة  
وحدة ضمان الجودة

رئيس الجامعة  
إ.د. القاسم محمد عباس

مركز التطوير الأكاديمي وضمان الجودة  
إ.د. هدى العماد

عميد الكلية  
إ.د. خالد الشويه

وحدة ضمان الجودة  
إ.د. محمود البريهي