



T-104  
2022

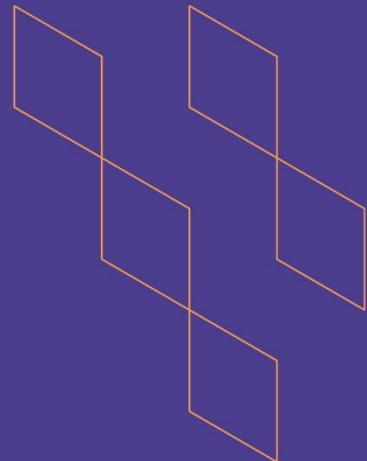
# Course Specification





T-104  
2022

## Course Specification



Course Title:	Pharmaceutical Analytical Chemistry
Course Code:	PHC 212
Program:	Pharmaceutical Sciences
Department:	Pharmaceutical chemistry
College:	Pharmacy
Institution:	Najran University
Version:	CS-V1
Last Revision Date:	8-6-1445



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## A. General information about the course:

Course Identification	
1. Credit hours:	<b>3 hours (2+1)</b>
2. Course type	
a.	University <input type="checkbox"/> College <input checked="" type="checkbox"/> Department <input type="checkbox"/> Track <input type="checkbox"/> Others <input type="checkbox"/>
b.	Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
3. Level/year at which this course is offered:	4 <sup>th</sup> level / second year
4. Course general Description	
<p>This course focuses on various principles of basic and pharmaceutical analytical chemistry that are used for quantitative analysis of substances. This includes the fundamentals of all types of volumetric analysis such as acid-base, precipitometry, complexometry and redox titrations and their applications. Also, the course deals with the fundamentals of UV-VIS, IR and electrochemical instrumental analysis and their applications. The practical part deals with training students on all types of titrations as well as the mathematical calculations and formulas needed for calculation of the final concentrations as well as identifying and operating the instruments</p>	
5. Pre-requirements for this course (if any): <b>None</b>	
6. Co- requirements for this course (if any): <b>None</b>	
7. Course Main Objective(s)	
<ol style="list-style-type: none"> <li>1- Explain the principles and fundamentals of the quantitative volumetric analysis of substances such as acid-base, precipitometry, complexometry and redox titrations</li> <li>2- Explain the principles and fundamentals of the quantitative analysis of substances using UV-VIS, IR and electrochemical instruments</li> <li>3- Applications of the volumetric analysis of pharmaceutical compounds and minerals</li> <li>4- Apply the volumetric titrations professionally</li> <li>5- Apply the instrumental analysis on UV-VIS professionally and on electrochemical with guidance</li> </ol>	

### 1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	100
2.	E-learning	0	0
3.	Hybrid <ul style="list-style-type: none"> <li>Traditional classroom</li> <li>E-learning</li> </ul>		

No	Mode of Instruction	Contact Hours	Percentage
4.	Distance learning		

## 2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	30
3.	Field	
4.	Tutorial	
5.	Others (specify) homeworks and assignments	30
	Total	105

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Describe the fundamentals of all types of titrations and instrumental analysis and their applications	K3	Lectures	Theoretical exams Assignment
1.2				
...				
2.0	Skills			
2.1	Plan strategies for the creative solutions of analytical problems	S1	Lectures, Problems Solving	Theoretical exams
2.2	Demonstrate pharmaceutical calculation, isolation, and drug development skills using advanced techniques, tools and instruments as well as results interpretation	S3	Practical work	Observation card or Work Place-Based Assessment (WPBA) Practical Exam (OSPE)
2.3	Communicate clearly and effectively with professionals, administrative staff and supportive personnel	S5	Seminars Practical work	Assignment Laboratory reports
3.0	Values, autonomy, and responsibility			
3.1	Work independently and professionally with <b>independent thinking</b>	V4	Practical work	Work Place-Based Assessment (WPBA) Practical Exam
3.2	Demonstrate accountability, confidence, and Use properly the	V4	Practical work	Practical Exam



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	chemicals according to the rules of good laboratory practice			
...				

## C. Course Content

No	List of Topics	Contact Hours
1	<b>Introduction into analytical Chemistry</b>	1
2	<b>Validation of analytical methods (Calibration plot, Linear range, LOD, LOQ and accuracy &amp; precision)</b>	3
3	<b><u>Quantitative volumetric analysis (Titrations)</u></b> <ol style="list-style-type: none"> <li>Requirements of the reactions suitable for titration</li> <li>Standard solutions and their preparations</li> <li>Sources of errors in volumetric titrations</li> <li>Theories of acids and bases</li> <li>pH of acids, bases and salts</li> <li>Buffer solutions; types, composition, preparation and their importance</li> <li>Acid-base indicators</li> <li>Titration curves</li> <li>Applications of acid-base titrations <ol style="list-style-type: none"> <li>Direct acid-base analysis of strong acids and bases</li> <li>Direct acid-base analysis of <math>\text{Na}_2\text{CO}_3</math> and boric acid</li> <li>Double indicator titration</li> <li>Back titrations; requirements and examples</li> </ol> </li> </ol> <p>Analysis of mixtures of 2 substances</p>	8
4	<b><u>Precipitometry</u></b> <ol style="list-style-type: none"> <li>Fundamentals of precipitometric titrations.</li> <li>Methods for detection of the end point</li> <li>Applications of precipitometric titrations <ol style="list-style-type: none"> <li>Mohr's method</li> <li>Volhard's method</li> </ol> </li> </ol> <p>Fajan method and adsorption indicators</p>	4
5	<b><u>Complexometry</u></b> <ol style="list-style-type: none"> <li>Fundamentals of complexometric titrations</li> <li>Metallochromic indicators and complexon reagents</li> <li>Application of complexometric EDTA titrations and how to increase EDTA selectivity</li> </ol> <p>Masking and demasking</p>	6
4	<b><u>REDOX titrations</u></b> <ol style="list-style-type: none"> <li>Fundamentals of oxidation-reduction titrations</li> <li>Oxidation-reduction indicators and titration curves</li> </ol>	8





	<p>c. Redox reagents and their applications</p> <p>d. Application of redox systems in biological systems</p> <p>Iodine Involving titrations</p>	
5	<p><b><u>UV-VIS spectroscopy</u></b></p> <ol style="list-style-type: none"> <li>1. Absorption of UV-VIS radiations</li> <li>2. Types of electronic transitions and their wavelengths</li> <li>3. Factors affecting ultraviolet absorption.</li> <li>4. Beer's Lambert Law for quantitative analysis</li> <li>5. Deviations from Beer's Lambert law</li> <li>6. Instrumentation of UV-VIS spectrophotometers</li> </ol> <p>Application of the UV-VIS absorption in the pharmaceutical analysis of drug substances</p>	6
6	<p><b><u>IR spectroscopy</u></b></p> <ol style="list-style-type: none"> <li>1. Absorption of IR radiations</li> <li>2. Types of vibrations and their wavelengths</li> <li>3. Factors affecting IR absorption.</li> <li>4. Instrumentation of IR spectrophotometers</li> </ol> <p>Application of IR in determination of functional groups</p>	3
7	<p><b><u>Electrochemical methods</u></b></p> <ol style="list-style-type: none"> <li>a- Introduction for electrochemistry and electrochemical cells</li> <li>b- Comparing galvanic and electrolytic cells and their uses.</li> <li>c- Potentiometry and types of electrodes</li> <li>d- Application of potentiometry.</li> <li>e- Fundamentals and types of voltammetry</li> <li>f- Polarography: theory, instrumentation and applications</li> <li>g- Conductometry: Fundamentals and instrumentation</li> </ol> <p>Conductometric titrations in pharmaceuticals</p>	6
Total		45
<b><u>Practical sessions</u></b>		
<b><u>List of experiments in this course</u></b>		
<ol style="list-style-type: none"> <li>1. Lab 1. Safety introduction and fundamentals of the titration</li> <li>2. Lab 2 Determination of pH of solutions and buffers</li> <li>3. Lab 3. Acid-base titration (0.1N HCl ≠ NaOH)</li> <li>4. Lab 4 Mohr's method</li> <li>5. Lab 5 Complexometric titration of <math>Mg^{2+}</math> by EDTA</li> <li>6. Lab 6 Redox titration of oxalic acid by <math>KMnO_4</math></li> <li>7. Lab 7 Redox titration of <math>H_2O_2</math></li> <li>8. Lab 8 Validation parameters statistics in the laboratory</li> <li>9. Lab 9 Beer's Lambert Law plot</li> <li>10. Lab 10 Determination of pharm. compounds by UV</li> <li>11. Lab 11 IR Identification (e.g. paracetamol, and aspirin).</li> <li>12. Lab 12 conductometric titration of HCl and NaOH demonstration</li> <li>13. Final practical exam on week number 14</li> </ol>		30





## D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz #1	6	10%
2.	Midterm exam	9	20%
3.	Individual assignments	12	5%
4.	Lab. practical quiz or Lab report	12	5%
5.	Observation card in lab	2-13	10%
6.	Final practical Exam	15	10%
7.	Final exam	16	40%
8.			

\*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

## E. Learning Resources and Facilities

### 1. References and Learning Resources

Essential References	<ol style="list-style-type: none"> <li>1. Vogel's Quantitative chemical Analysis, 7th Edition, 2009</li> <li>2. Analytical Chemistry by Christian, G.D. 7th Edition, John Wiley and Sons: New York, 2014.</li> </ol>
Supportive References	<ol style="list-style-type: none"> <li>1. Vogel's Quantitative chemical Analysis, 7th Edition, 2009</li> <li>2. Power point slides</li> </ol>
Electronic Materials	<a href="http://www.dlaf.nu.edu.sa">www.dlaf.nu.edu.sa</a>
Other Learning Materials	

### 2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	<p>Suitable lecture room equipped with data show and internet and sufficient number of seats.</p> <p>Suitable laboratories equipped with health and safety tools, internet and sufficient number of seats.</p>
Technology equipment (projector, smart board, software)	Computers, data show, sound systems and internet
Other equipment (depending on the nature of the specialty)	<ol style="list-style-type: none"> <li>1. Volumetric flasks of different volumes</li> <li>2. Conical flasks</li> <li>3. Burets</li> <li>4. pipettes</li> <li>5. Water bath</li> <li>6. Hot plates</li> <li>7. pH meters</li> <li>8. UV-VIS spectrophotometer</li> <li>9. IR spectrometer</li> <li>10. HPLC instrument</li> <li>11. Filtration unit</li> </ol>

## F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Head of departments and students	Indirect Questionnaires (indirect)
Effectiveness of students assessment	Faculty members and students	Indirect Questionnaires (indirect)
Quality of learning resources	Students	Questionnaires (Indirect)
The extent to which CLOs have been achieved	Student peer reviewer	Direct Indirect
Other		

**Assessor** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval Data

<b>COUNCIL /COMMITTEE</b>	Pharmaceutical Chemistry Department Council
<b>REFERENCE NO.</b>	Council No.
<b>DATE</b>	8-06-1445

