Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment

Course Specifications
(CS)

Course code:	CHEM 350
Course title:	Instrumental Methods of Analysis
Date:	28/01/1438 H, 29/10/2016 G

Course Specifications

Institution: King Saud University	**Date:** 28/01/1438 H, 29/10/2016 G
College/Department: College of Science / Department of Chemistry	

A. Course Identification and General Information

1. Course title and code
CHEM350 Instrumental Methods of Analysis

2. Credit hours
4 Credit hours; (2 Lecture + 2 Practical)

3. Program(s) in which the course is offered
(If general elective available in many programs indicate this rather than list programs)
Chemical Engineering

4. Name of faculty member responsible for the course
Dr. Ahmad Aqel Ifseisi
Prof. Saad Al Tamrah
TA: Kamal Eldeen Omar

5. Level/year at which this course is offered
7th level / 4th year

6. Pre-requisites for this course (if any)
General Chemistry, CHEM101

7. Co-requisites for this course (if any)
No requests

8. Location if not on main campus
Main campus, Chemistry Department

9. Mode of Instruction (mark all that apply)

a. traditional classroom	√	What percentage?	70%
b. blended (traditional and online)		What percentage?	
c. e-learning		What percentage?	
d. correspondence		What percentage?	
f. other (practical in laboratory)	√	What percentage?	30%

Comments:

B. Objectives

1. What is the main purpose for this course? The main purpose of this course is to help the students to learn and understand several concepts in spectroscopic and electro-analytical methods. By the end of this course, students expected to: - Understand the basic principles of electromagnetic radiation. - Be familiar with some of the spectroscopic techniques such as fluorometry, phosphorometry and chemiluminescence. - Understand the basics of molecular and atomic spectrometry. - Know the proper analysis tool for specific metals or compounds. - Understand the basic principles of electro analytical techniques. - Recognize the theory of the three main categories electro analytical methods; potentiometry, coulometry and voltammetry. - Learn how to treat with the spectroscopic and electrochemical experimental data. This course also designed to give students the opportunity to perform and evaluate different spectroscopic and electro analytical experiments, to identify various standard compounds, and to deal with some traditional and modern analytical instruments.
2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field) This course designed to give students the opportunity to evaluate and develop the contents of this course by using of new technologies such as the internet and the scientific databases for collection of the information.

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description: This course designed and conducted to the laboratory experiments to give the students the basic principles of the spectroscopic and electro-analytical methods.

1. Topics to be Covered		
List of Topics (Lectures + Tutorial)	**No. of Weeks**	**Contact hours**
Introduction to qualitative and quantitative analysis	½	1
Introduction to instrumental methods of analysis	½	1
An introduction to spectrometric methods	1	2
Wave properties of electromagnetic radiation	1	2
Basic principles of atomic and molecular spectrometry	3	6
Spectrometric instrumentation	1	2
Atomic absorption, emission and fluorescence spectrometry	2	4
Molecular photoluminescence spectroscopy	1	2
Basic principles of electro-analytical techniques	3	6
Basics of voltammetry and potetiometry	1	2
Brief introduction to coulometry and conductimetry	1	2

Total	**15**	**30**
List of Topics (Laboratory)	**No. of Weeks**	**Contact hours**
Spectrophotometric determination of manganese	1	4
Spectrophotometric determination of permanginate and dichromate mixture	1	4
Spectrophotometric determination of total iron (Fe^{2+}, Fe^{3+}) using 1,10-phenanthroline and determine the molar absorptivity	1	4
Spectrophotometric study of compleximetric compounds	1	4
Determination of preservatives (benzoic acid) in soft drinks by molecular absorption of UV spectoscopy	1	4
Determination Na and K in drinking water using flame atomic emission	1	4
Optimize determination of Ca using flame atomic absorption	1	4
First practical exam	1	4
Determination of phosphoric acid using pH titration	1	4
Potentiometric titrations of oxidation-reducttion reactions between (Fe^{2+} and Ce^{4+})	1	4
Polarographic study of metals	1	4
Amperometric titration of lead with dichromate using droping mercury electrode	1	4
Conductimetric titrations	1	4
Second practical exam	1	4
Total	**14**	**56**

2. Course components (total contact hours and credits per semester):						
	Lecture	Tutorial	Laboratory or Studio	Practical	Other	Total
Contact Hours	30 (15x2)	---	56 (14x4)	---	---	86
Credit	2	---	2	---	---	4

3. Additional private study/learning hours expected for students per week. 3h

-Three hours per week for laboratory reports, homework and assignments

-During the practical section, students will be exposed to some traditional and modern techniques for analysis of several chemicals. Various spectroscopic and electro-chemical techniques such as AAS, AES, ICP, and other instruments for measuring cell potential and voltage will be included. Each experiment consists of general principles, components of the system and applications

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

-A brief summary of the knowledge or skill the course is intended to develop
-A description of the teaching strategies to be used in the course to develop that knowledge or skill
The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain).

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the difference between traditional and instrumental analytical techniques	-Lectures using modern methods of teaching with smart boards -Discussion -Homework -Training -Real examples -Proposing stimulation questions -Demonstrations using models and animations -Laboratory experiments	-Homework assignments -Short quizzes -Direct questions -Midterm exam -Final exam -Laboratory reports -Practical exams
1.2	Define the basic principles of spectroscopic methods		
1.3	Describe the basic components of any spectroscopic technique		
1.4	Recognize the basics of molecular and atomic spectrometry		
1.5	Recall some of the spectroscopic techniques such as fluorometry, phosphorometry and chemiluminescence		
1.6	Define the basic principles of electro analytical techniques		
1.7	Recognize the theory of the three main categories electro analytical methods; potentiometry, coulometry and voltammetry		
1.8	Outline how to treat with the spectroscopic and electrochemical experimental data		
1.9	Memorize and list the proper analysis tool for specific metals or compounds		
2.0	**Cognitive Skills**		
2.1	Differentiate between traditional and modern instrumental analytical techniques	-Group discussions -Homework assignments -Solving problems -Using available electronic technology in teaching -Laboratory experiments -Preparing laboratory	-Following up students' participations in group discussion activities -Short quizzes -Direct questions -Midterm exam -Final exam -Laboratory reports
2.2	Predict and explain the proper analysis tool for specific metals or compounds		
2.3	Recognize the basic principles of spectroscopic and electro analytical methods		
2.4	Explain the basic components of some spectroscopic and electro analytical technique		

2.5	Collect, represent and interpret experimental data	reports -Connect of the knowledge with the real examples	-Homework assignments -Practical exams
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work independently and as a part of a team; discuss and solve the problems individually and with group	-Laboratory experiments -Solving problems with group -Group discussion, group homework and case studies -Writing laboratory reports	-Performance during problems solving discussions -Evaluating individual and group works -Homework assignments -Evaluating laboratory reports -Practical laboratory quizzes and exam
3.2	Illustrate and communicate ideas to other students in laboratory		
3.3	Use standard laboratory equipment, classical and modern instrumentation techniques to carry out experiments with safety		
4.0	**Communication, Information Technology, Numerical**		
4.1	Use the computer and internet to search about the required information	-Provide these programs for students -Training the students -Using these programs in chemistry courses -Encourage students to collect information through university provided Wi-Fi	-Observation -Demonstration -Discussion -Short problems -Performance in problem solving and case studies -Evaluating the proficiency in communicating the results
4.2	Use of computer programs to illustrate some concepts and to calculate and solve problems		
4.3	Utilize university electronic resources of learning		
4.4	Interpret of numerical, chemical and general scientific information		
5.0	**Psychomotor**		
5.1	Demonstrate safe handling of laboratory chemicals and glassware during experiments	-Perform laboratory experiments individually and in groups	-Laboratory reports and practical exams

5. Map course LOs with the program LOs. (Place course LO #s in the left column and program LO #s across the top).

Course LOs #	Program Learning Outcomes (Use Program LO Code #s provided in the Program Specifications)															
	1.1	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**3.4**	**3.5**	**4.1**	**4.2**	**4.3**	**5.1**
1.1	√		√													
1.2			√													
1.3	√		√													
1.4	√	√														
1.5	√	√														
1.6	√		√													
1.7	√															
1.8			√													

1.9	√	√														√
2.1						√										
2.2				√		√										
2.3				√		√										
2.4				√		√										
2.5					√		√									
3.1								√	√		√	√				
3.2										√	√					
3.3									√							
4.1															√	
4.2													√		√	
4.3															√	
4.4														√	√	
5.1																√

6. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm exam	6-8	20%
2	Assignment, discussion, homework's and attendance	---	10%
3	Laboratory reports, quizzes and practical exams	---	30%
4	Final exam	16-17	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)
- Office hours: 6 h/week
- Laboratory assistance

E. Learning Resources

1. List Required Textbooks
- Ibrahim Al-Zamil, "Analytical Chemistry, Instrumental Analysis" 5th Ed., Al-Khrigi Publisher, 2015

2. List Essential References Materials (Journals, Reports, etc.)
Non

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
- G.D. Christian, P.K. Dasgupta, K.A. Schug, "Analytical Chemistry", 7th Ed., John Wiley & Sons, 2013

- D.A. Skoog, F.J. Holler, S.R. Crouch, "Principles of Instrumental Analysis", 6th Ed., Brooks Cole, 2006 - Encyclopedia of chemistry
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc. - All lectures are available on the web site (https://fac.ksu.edu.sa/aifseisi) - Several videos and animations are available on the web site
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software. -Microsoft Excel -Handouts and Power Point Presentations

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) - Classroom for 30 students equipped with modern teaching technology - Laboratory in accordance with the rules of safety and equipped with the required instruments and chemicals
2. Computing resources (AV, data show, Smart Board, software, etc.) - The presence of computer, E-podium, projector, smart board and internet in classrooms
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) - The presence of chemicals and standards used in analytical - The presence of related analytical equipment and instruments - The presence of the first aid and safety equipment

G. Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching - Course evaluation by students - Student faculty meeting - Student questionnaires - E-suggestion
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department - Revision by the analytical chemistry regular committee meeting - Survey of the graduated students
3. Processes for Improvement of Teaching - Attending workshops and conferences given by experts on the teaching and learning methodologies - Monitoring of teaching activities by senior faculty members - Training through Deanship of Skills Development

- Increase the using of modern technology methods in teaching such as learning management system
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) - Checking a sample of the student's work, exams and assignments by other staff member in the department
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement - Collecting all reports and evaluations at the end of the year for a reviewing purpose - Invite external expert to evaluate the course - Workshops for the teachers - Consult teachers with long experience

Name of Instructor: Ahmad Aqel IFSEISI

Signature:

Date Report Completed: 28/01/1438 H, 29/10/2016 G

Name of Field Experience Teaching Staff: Separation and chromatographic methods

Program Coordinator:

Signature:

Date Received: