ATTACHMENT 2 (e)

Course Specifications

Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment

Spectrophotometric and Electrochemical techniques

4023555-3

Course Specifications
(CS)

Course Specifications

Institution: **Umm Al-qura University** Date of Report: 2017
College/Department : **Faculty of Applied Science/ Department of Chemistry**

A. Course Identification and General Information

1. Course title and code: **Spectrophotometric and Electrochemical techniques /4023555-3**
2. Credit hours: **3 hrs** (2 theoretical + 1 practical)
3. Program(s) in which the course is offered. **Chemistry and Industrial Chemistry**
4. Name of faculty member responsible for the course: **Prof. Amr L Saber**
5. Level/year at which this course is offered: **5th level/3rd year**
6. Pre-requisites for this course (if any): **Volumetric analysis**
7. Co-requisites for this course (if any)---
8. Location if not on main campus: **both on El-Abdyah, and El-Zaher**
9. Mode of Instruction (mark all that apply)

a. Traditional classroom	■	What percentage? 100%	
b. **Blended (traditional and online)**		What percentage?	
c. e-learning		What percentage?	
d. Correspondence		What percentage?	
f. Other		What percentage?	

Comments:

B Objectives

1. What is the main purpose for this course? **By the end of this course student have all information about the instrumental analysis and have ability to determine the trace amounts of different compounds and metals.**
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) **The students will be mentioned to prepare an essay or a report from literature using the library, data base services, and/or websites to follow up and update the new topics of the subject of the course**

C. Course Description (Note: General description in the form to be used for the Bulletin or handbook should be attached)

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
a. General properties of electromagnetic radiation and its interaction with matter, the electromagnetic spectrum as well as the absorption and emission of electromagnetic radiation.	2	4
b. Atomic spectra, molecular spectra, scattered radiation, refracted radiation, dispersed and diffracted radiation, monochromatic vs. polychromatic radiation.	1	2
c. Instrumentation, radiation sources, monochromators, sample cell (cuvette), detectors, single-beam and double-beam spectrophotometers and photometers.	1	2
d. Ultraviolet and visible molecular absorption spectroscopy, Beer's law, true and apparent deviations from Beer's law, application of Beer's law to mixtures, calibration curve and the standard addition method.	1	2
e. Absorbing species, absorption by organic compounds, charge-transfer absorption and ligand-field absorption bands.	1	2
f. Qualitative and quantitative analysis by UV-Vis. Applications of spectrophotometric methods in chemical equilibrium studies, spectrophotometric titrations	1	2
g. Turbidimetry and nephelometry	1	2
h. Molecular fluorescence spectroscopy, theory of molecular fluorescence, relaxation process, resonance lines and stokes shifts, relationship between excitation spectra and fluorescence spectra, effect of structure, temperature and solvents on fluorescence, effect of concentration on fluorescence intensity, instrumentation and applications in organic and inorganic analysis.	1	2

i. Flame emission and atomic absorption spectroscopy, nebulisation, burners and nebulizers, flames and flame temperature, interferences, flame spectrometric techniques, flame emission spectrometry, flame photometer, flame atomic absorption spectrometry and applications	2	4
j. Introduction to electroanalytical methods, pH and ion selective potentiometry, glass-membrane electrodes, solid-state sensors, liquid-membrane electrodes, gas-sensing and enzyme electrodes, interferences, potentiometric titrations	1	2
k. Voltammetry, polarography and amperometric titrations, current-voltage relationships, characteristics of dropping mercury electrode, half-wave potential, modern voltammetric techniques (ASV and CSV), instrumentation, applications, two indicator electrodes amperometric titrations	1	2
l. Electrogravimetry and calorimetry, basic principles, equipment for electrolytic separation, electrogravimetry, coulometry and coulometric titrations, conductance methods, electrolytic conductivity, measurement of electrolytic conductance, direct concentration determination, conductometric titrations	1	2

Labortory Part:

- Determine copper in copper sulphate solution using spectrophotometric methods
- Determine iron in its salt solution using spectrophotometric methods
- Study reduction oxidation reactions by spectrophotometric methods
- Analysis of $KMnO_4$ and $K_2Cr_2O_7$ in mixture using UV-Vis. spectrophotometer
- Determination of copper using potentiometric titration
- Potentiometric EDTA titrations with the mercury electrode
- Determination of ascorbic acid in fruit juice using Polarographic method
- Determination of amino acids in their solutions
- Determination of hydroxyl group number

II-General scheme for identification of organic aliphatic unknown

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	28	-	36	-	-	64
Credit	2	-	1	-	-	3

3. Additional private study/learning hours expected for students per week. 2 h

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

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Describe the principles and applications of spectrophotometric and colormetric analysis	• Lectures • Scientific discussion • Library visits • Web-based study	• Exams • web-based student performance systems • portfolios • long and short essays • posters lab manuals
1.2	Identify electromagnetic spectrum and its interaction with matter		
1.3	Define absorption and emission of light by atoms and molecules-types of analysis and devices		
1.4	Recognize the spectrophotometric measurements theory and Beer's law deviation		
1.5	Familiar with spectrophotometric instrumentation – spectra measurements using UV-vis and IR		
1.6	Outline atomic absorption by electrothermal oven- X ray analysis – Applications		
1.7	Write an atomic emission spectroscopy and the interference study		
1.8	Determine the electrochemical methods in quantitative analysis – Introduction to the principles		
1.9	Recognize the potentiometric methods and Potentiometric titrations		
1.10	Memorize voltammetry and polarography techniques		
1.11	Outline conductmetric methods and their titrations		
2.0	**Cognitive Skills**		
2.1	Analyze electromagnetic spectrum and its interaction with matter	• Lectures • Scientific discussion • Library visits • Web-based study	• Exams • web-based student performance systems • portfolios • posters • demonstrations
2.2	Summarize the principles and applications of spectrophotometric and colormetric analysis		
2.3	Explain the turbidity analysis and flame photometry		
2.4	Apply Beer's law applications		
2.5	Interpret the inductively coupled plasma (ICP)– principles and applications		
2.6	Compare between voltammetry and polarography techniques		
2.7	Measure using conductmetric methods and their titrations Evaluate atomic absorption by electrothermal oven- X ray analysis – Applications Demonstrate potentiometric methods and Potentiometric titrations		
3.0	**Interpersonal Skills & Responsibility**		

• Ability to work in a team to perform a specific experimental tasks. • Ability to work independently to handle chemicals • Ability to communicate results of work to classmate and participation in class or ab oratory discussions	• Class discussions • Research activities	• Performance on in-practical exams. • Work on research activity. • Overall student performance in Lab. discussions • Cross questions after finishing laboratory work
4.0	**Communication, Information Technology, Numerical**	
1. Encourage students to use internet for searching certain electronic journals regarding topics of the course. 2. Scientific writing. 3. Use his/her observations to solve problems. 4. Doing research and conduct searches for restoring information. 5. Able to calculate and discuss the facts and logical propose methods to solve the difficulties.	• Lectures • Scientific discussion • Library visits • Web-based study	• web-based student performance systems • individual and group presentations
5.0	**Psychomotor**	
Laboratory practice . including 1.Locate Materials Safety Data Sheets, chemicals carcinogens list, and hazardous chemicals list. 2. Handle chemicals safely with a proper PPE 3.Dilute solutions, repeat analysis and calculate true result for all procedures performed as required. 4.Pipette accurately at all times 5. Titrate and weight efficiently in right way 6.Dispose the hazardous solution in right way	Practical session should include both demonstration and experiments .	1.Repetition of the experiments , to reproduce the results 2.Written report of chart and procedures. 3.The students should be able to correlate their results with experimental conditions

5. 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	Homework or activities.	--	10 %
2	Midterm Exam.	8	20 %
3	Practical Exam.	14	30 %
4	Final Exam. (2hours Exam)	16	40 %
5	**Total**	**100 %**	

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)

- **We have faculty members to provide counseling and advice.**
- **Office hours: During the working hours weekly.**
- **Academic Advising for students.**

E. Learning Resources

1. List Required Textbooks
   - K. Danzer, ***Analytical Chemistry, Theoretical and Metrological Fundamentals***, Springer(2014)

2. List Essential References Materials (Journals, Reports, etc.)
   - Lecture Hand outs available on the coordinator website

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
   - Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, ***Analytical Chemistry***, 7th edition, WILEY (2014)
   - Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, ***Analytical Chemistry***, 7th edition, Springer (2014)
   - Dhruba Charan Dash. *Analytical Chemistry* (2017) PHI Learning Private Limited.

4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)
   - **http://www.chemweb.com**
   - **http://www.sciencedirect.com**
   - **http://www.rsc.org**

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

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.) • **Classrooms capacity (30) students.** • **Providing hall of teaching aids including computers and projector.**

2. Computing resources (AV, data show, Smart Board, software, etc.)
▪ **Room equipped with computer and projector and TV.**
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) • **No other requirements.**

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching Complete the questionnaire evaluation of the course in particular.
2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor • **Observations and the assistance of colleagues.** • **Independent evaluation for extent to achieve students the standards.** • **Independent advice of the duties and tasks.**
3 Processes for Improvement of Teaching • **Workshops for teaching methods.** • **Continuous training of member staff.** • **Review of strategies proposed.** • **Providing new tools for learning.** • **The application of e-learning.** • **Exchange of experiences internal and external.**
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) ▪ **Check marking of a sample of exam papers, or student work.** ▪ **Exchange corrected sample of assignments or exam basis with another staff member for the same course in other faculty.**
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- **Periodic Review of the contents of the syllabus and modify the negatives.**
- **Consult other staff of the course.**
- **Hosting a visiting staff to evaluate of the course.**
- **Workshops for teachers of the course.**

Faculty or Teaching Staff: Prof. Amr L Saber

Signature: **Date Report Completed: 12/1/2019**

Received by: Dr. Ismail Althagafi Department Head

Signature: **Date: 20/1/2019**