COURSE SPECIFICATIONS

Form

Course Title: **Chemometrics and Data Analysis**

Course Code: **4026847-3**

Date: 23-10-2018	**Institution:** **Umm Al-Qura University**.
College: **Faculty of Applied Science**	**Department:** **Department of Chemistry**

A. Course Identification and General Information

1. Course title and code: **Chemometrics and Data Analysis / 4026847-3**
2. Credit hours: **3 hrs. (Theoretical)**
3. Program(s) in which the course is offered. **M. Sc. in Chemistry**

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course: **Dr. Amr Lotfy Saber**
5. Level/year at which this course is offered: **3rd / 2nd**
6. Pre-requisites for this course (if any): **not applicable**
7. Co-requisites for this course (if any): **not applicable**
8. Location if not on main campus: **El-Abedyah, El-Azizya, and El-Zaher**
9. Mode of Instruction (mark all that apply):

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

Comments:

B Objectives

1. The main objective of this course

By completing this course, the students will be able to:

- Understand the quality of analytical measurements.
- Know the relation between model and data; experimental design and optimization.
- The course also will cover multivariate mixture analysis and multivariate image analysis of hyper-spectral images.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

- Encourage students to carry out research reports in the course subjects using the library, data base services, and/or websites.
- Changes in content as a result of new research in the field.
- The use of smart teaching halls for lectures.
- Increased use of IT or web based reference material.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
• Chemical data analysis: bias and precision, statistics of repeated measurements, normal distribution and properties, significant tests.	1	3
• Quality of analytical measurements; Calibration methods: Regression and correlation, confidence limits, limit of decision, limit of detection, standard additions.	2	6
• Non-parametric and robust methods (Box and Whisker plot).	1	3
• The relation between model and data; Experimental design and Optimization: Two-way analysis of variance (ANOVA), one-way analysis of variance (ANOVA).	2	6
• Multivariate data analysis: Principal component analysis, dendograms.	1	3

• Applications of analytical techniques in research and development.	**1**	**3**
• Fundamentals of many commonly used chemometric methods including exploratory data analysis, pattern recognition.	**2**	**6**
• Regression and classification methods (PCA, PLS, SIMCA,PLS-DA).	**1**	**3**
• Multivariate mixture analysis and multivariate image analysis of hyper-spectral images.	**2**	**6**
• Revision	**1**	**3**

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

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	39	--	--	--	--	39
	Actual	39	--	--	--	--	39
Credit	Planned	3	--	--	--	--	3
	Actual	3	--	--	--	--	3

3. Individual study/learning hours expected for students per week. 3 hrs

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Identify the calibration methods: Regression and correlation, confidence limits, limit of decision, limit of detection and standard additions.	• Lectures • Scientific discussion • Use the library to work duties and a	• Written mid-term and final exams. • Long and short
1.2	Describe the chemical data analysis: bias and precision.		

1.3	Understand the Quality of analytical measurements.	small research on chemomatrices and data analysis. • Use of the internet to carry out some reports on course subjects.	essays.
1.4	Write about applications of analytical techniques in research and development.		
1.5	Explain the two-way analysis of variance (ANOVA)		
1.6	Outline the multivariate data analysis and principal component analysis.		
1.7	Recording the relation between model and data.		
2.0	**Cognitive Skills**		
2.1	Report a multivariate mixture analysis and multivariate image analysis of hyper spectral images.	• Lectures • Scientific discussion • Library visits • Web-based study • Using brain storming at the beginning of each lecture in order to stimulate the students towards the new topic of the course. • Enhancing open discussion during the lecture.	• Exams • web-based student performance systems • portfolios • long and short essays • Through assignments and homework.
2.2	Interpret the deference between non-parametric and robust methods (Box and Whisker plot).		
2.3	Construct amultivariate data analysis.		
2.4	Modify the quality of analytical measurements.		
2.5	Confirm the relation between model and data.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Operate in team work and accept his college's opinions.	• Dividing students into groups to carry out collective scientific reports. • Periodic individual duties to develop the skill of taking responsibility and self-reliance.	• Evaluate the results of collective works and duties as well as knowing the contribution of each individual through dialogue and discussion. • Assessment of individual tasks and duties to determine the student's ability
3.2	Choose the suitable method to solve problems.		
3.3 Develop the student's ability in self-reliance and responsibility.			

			to self-reliance.
4.0	**Communication, Information Technology, Numerical**		
4.1	Use computers and the international information network (the Internet) to perform calculations and to identify recent research relevant to decision sources.	• Visiting research centers. • The use of computers in the training room of the department. • Using the internet for collecting data.	• Evaluation of the duties associated with the proper use of numerical and communication skills. • Web-based student performance systems. • Individual and group presentations.
4.2	Communicate effectively in oral and written forms.		
4.3	Use basic mathematical and statistical techniques to perform data analysis.		
5.0	**Psychomotor(if any)**		
5.1	NOT APPLICABLE		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Activities and Assignments.	--	10 %
2	Midterm Exam.	8	30 %
3	Final Exam.	15-16	60 %
4	**Total**	**100%**	

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

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

E Learning Resources

1. List Required Textbooks

- *Chemometrics: Data Analysis for the Laboratory and Chemical Plant,* Richard G. Brereton, 2003, Wiley.
- *Chemometrics with R Multivariate Data Analysis in the Natural Sciences and Life Sciences*, Ron Wehrens auth.2011, Springer Heidelberg Dordrecht London New York.

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

- Matthias Otto, "Chemometrics: Statistics and Computer Application in Analytical Chemistry", 3rd ed., Wiley-VCH, 2016.

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

- www.spectroscopynow.com.
- www.statsoft.com/textbook/stathome.html.
- http://davidmlane.com/hyperstat/.
- www.psychstat.smsu.edu/MultiBook/mlt00.htm.

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

None

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.)

- Equipped lecture hall equipped specializing in chemometrics and data analysis.

2. Technology 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 Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

- Structured group discussions and/or focus groups.
- Questionnaires can be used to collect student feedback.
- Student representation on staff-student committees and institutional bodies.

2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

- The instructor's statement of his/her goals for the course, teaching methods and philosophy, student outcomes, and plans for improvement are a critical source of information.
- A systematic self-review has the potential for contributing significantly to the instructor's teaching improvement by focusing on the strengths and weaknesses of the course in light of his/her original course objectives.
- Visits by other faculty can provide information about the process of teaching.
- Colleagues have the expertise to evaluate the quality of a course as evidenced by its content and format (peer reviewers).

3. **Procedures for Teaching Development**

- Providing new tools for learning.
- The application of e-learning.
- Exchange of experiences internal and external.
- Training programs and workshops for Staff member.
- Review of strategies proposed.

4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)

- 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.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.

- Workshops for teachers of the course.
- 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.

Name of Course Instructor: ____Prof. Amr Lotfy Saber_____

Signature:  **Date Completed: ___23/10/2018_____**

rogram Coordinator: Dr. Ismail Ibrahim Althagafi

Signature:  **Date Received: 24/10/2018**