



Course Syllabus: Spectroscopy Analysis - ChemS 212

Division	Physical Science and Engineering Division
Course Number	ChemS 212
Course Title	Spectroscopy Analysis
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	02:30 PM - 04:00 PM Sun Thu

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Kuo-Wei Huang	kuowei.huang@kaust.edu.sa	+966128080328	4232, 3, Ibn Sina (bldg. 3)	Sun 4:40-5:30 PM
Omar Farghaly Mohammed Abdelsaboer	Omar.Abdelsaboer@KAUST. EDU.SA	+966128084491		Thu 4:40-5:30 PM

Teaching Assistant(s)	
Name	Email

Course Information	
Comprehensive Course Description	This course will give an introduction to modern spectroscopic techniques including time-resolved laser methods. It is target towards master and PhD students in chemistry, materials science, electrical engineering, and bioscience. Theory and application to chemical research problems on will be discussed, including mass spectrometry, ultraviolet and visible spectroscopy, infrared spectroscopy, Raman, fluorescence, nuclear magnetic resonance spectroscopy, time-resolved spectra including lifetime measurements, etc. Emphasis will be placed on training the students to interpret spectra and to design experiments to address questions related to selectivity, reactivity, kinetics, etc. One NMR laboratories session will allow the students to be familiar with standard operations to acquire 1D and 2D spectra. It also provides detailed information about many photo-physical processes and every possible deactivation pathways of the excited systems including organic, inorganic and nanoscales materials.
Course Description from Program Guide	An introduction to the theory, application, and interpretation of four (4) major types of spectroscopy: absorption, infrared, and nuclear magnetic resonance spectroscopy, and mass spectrometry. It will focus heavily on interpretation of spectra and application of these tools to address questions of structure and reactivity of organic, organometallic, and inorganic materials. A training session of two (2)- dimensional nuclear magnetic resonance (COSY, NOESY, HSQC, HMBC, etc) will be offered.
Goals and Objectives	This course will give an introduction to modern spectroscopic techniques including time-resolved laser methods. It is target towards master and PhD students in chemistry, materials science, electrical engineering, and bioscience. Theory and application to chemical research problems on will be discussed, including mass spectrometry, ultraviolet and visible spectroscopy, infrared spectroscopy, Raman, fluorescence, nuclear magnetic resonance spectroscopy, time-resolved spectra including lifetime measurements, etc. Emphasis will be placed on training the students to interpret spectra and to design experiments to address questions related to selectivity, reactivity, kinetics, etc. One NMR laboratories session will allow the students to be familiar with standard operations to acquire 1D and 2D spectra. It also provides detailed information about many photo-physical processes and every possible deactivation pathways of the excited systems including organic, inorganic and nanoscales materials.

Required Knowledge	Organic Chemistry and Inorganic Chemistry
Reference Texts	Spectrometric Identification of Organic Compounds, 7th Edition by Robert M. Silverstein, Francis X. Webster, David Kiemle Publisher: John Wiley & Sons
Method of evaluation	40.00% - Midterm exam 20.00% - Research Project 20.00% - Problem sets 20.00% - Active participation
Nature of the assignments	Two Problem sets 20% Two Midterms 40% one Final Project Presentation 20%
Course Policies	There will be two sets of tutorial questions given. Students are expected to submit written answers; the first set is due in class on March 5th, 2017 and the second set on Apr. 27th.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/22/2017 Thu 01/26/2017	Mass Spectrometry-I: Introduction of theory, ionization methods, molecule fragmentation.
2	Sun 01/29/2017 Thu 02/02/2017	Mass Spectrometry-II: Case studies
3	Sun 02/05/2017 Thu 02/09/2017	NMR Spectroscopy-I: Introduction of theory, ¹ H and ¹³ C NMR, Spin-Spin Coupling
4	Sun 02/12/2017 Thu 02/16/2017	NMR Spectroscopy-II: Case studies on 1D NMR
5	Sun 02/19/2017 Thu 02/23/2017	NMR Spectroscopy-III: 2D NMR techniques, pulse sequences
6	Sun 02/26/2017 Thu 03/02/2017	NMR Lab
7	Sun 03/05/2017 Thu 03/09/2017	NMR Spectroscopy-IV: Case studies on 2D NMR
8	Sun 03/12/2017 Thu 03/16/2017	Midterm I
9	Sun 03/19/2017 Thu 03/23/2017	Ultraviolet and Visible Spectroscopy: electronic transitions, radiative processes, energy diagram, internal conversion, conical intersection, Frank Condon principle, Kasha's rule, structure determination and solvent effect, and Fluorescence spectroscopy, Stokes Shift, fluorescence experiments, quenching, lifetime and quantum yield, fluorescence anisotropy.
10	Sun 03/26/2017 Thu 03/30/2017	Infrared Spectroscopy: Steady-state and time-resolved Infrared spectroscopy: from overview to potential applications
11	Sun 04/02/2017 Thu 04/06/2017	NO CLASS
12	Sun 04/09/2017 Thu 04/13/2017	Raman Spectroscopy: Standard Raman Spectroscopy vs Resonance-enhanced Raman Spectroscopy
13	Sun 04/16/2017 Thu 04/20/2017	Photoelectron spectroscopy: x-ray and Auger photoelectron spectroscopy, electron energy loss spectroscopy.
14	Sun 04/23/2017 Thu 04/27/2017	Application of steady-state and time-resolved laser spectroscopy in chemistry, materials science, physics and biology
15	Sun 04/30/2017 Thu 05/04/2017	Midterm II
16	Sun 05/07/2017 Thu 05/11/2017	Final Project Presentation
17	Sun 05/14/2017 Thu 05/18/2017	No final
18		

Note

The instructor reserves the right to make changes to this syllabus as necessary.