

CHE620: Advanced Techniques in Molecular Sensing

Program and Course Code	Chemical Engineering Program CHE620
Course Title	Advanced Techniques in Molecular Sensing
Credit Hours	3
Instructors	Dr. Hector H. Hernandez
Contact Information	Email: hhernandez@masdar.ac.ae Tel. +971 2 810 9102
Office Hours	Two hours for every hour of class, TBA in beginning of semester
Bulletin Course Description	The course focuses on current molecular sensing techniques. Student will be exposed to different molecular sensing techniques including, but not limited to light microscopy, fluorescence spectroscopy, x-ray spectroscopy, isothermal titration calorimetry, differential scanning calorimetry, transmission electron microscopy, scanning electron microscopy, analytical centrifugation, and dynamic light scattering. Challenges and opportunities for molecular sensing with different techniques.
Pre-requisites	CHE520 or equivalent
Co-requisites	None
Course Objectives (Student Learning Outcomes of the Course)	<p>After completing this course, students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate knowledge of the most current methods used to characterize and quantify biological based materials using the most up to date scientific equipment and methods • Use the various methods available to solve the challenges novel biomaterials pose • Work effectively in a multidisciplinary team to communicate through written reports on the incorporation of a multidisciplinary approach to problem solving of highly complex biomaterial design and characterization

Week	Course Topics and Contents
1	<ul style="list-style-type: none"> • Historical development of molecular imaging
2	<ul style="list-style-type: none"> • Mathematical model for molecular imaging technologies
3, 4	<ul style="list-style-type: none"> • Light microscopy / Fluorescence microscopy techniques
5, 6	<ul style="list-style-type: none"> • X-ray spectroscopy in molecular imaging
7,8	<ul style="list-style-type: none"> • Calorimetry and kinetics of molecular reactions
9, 10	<ul style="list-style-type: none"> • Electron microscopy and molecular systems
11, 12	<ul style="list-style-type: none"> • Size matters, analytical centrifugation and dynamic light scattering
13, 14,15	<ul style="list-style-type: none"> • Advanced experimental design in molecular imaging
16	Final Exam

Out-of-class assignments	
Homework	Several analytical and imaging simulation homework assignments will be given during the semester

Course Grading	
Homework	20 %
Laboratory Work	15%
Midterm Exam	30 %
Final Exam	30 %
Class Participation	5 %
Total	100 %

Class/Laboratory schedule and Methodology	
Class	The class meets 15 weeks, 2 lectures per week, 75 minutes each.
Laboratory	Computer laboratory will be used for software applications in multiphase flow in porous media
Teaching and learning methodologies	A combination of white board use, Power-point slide presentation, and interactive class discussions to encourage student participation and enhance the learning.

Course Materials	
Textbook(s)	<ul style="list-style-type: none"> • Biophysical chemistry – I-III: The conformation of biological, macromolecules, Cantor and Schimmel, W. H. Freeman and Company, San Francisco, 1980, 341 pp
Instructional material and resources	A course website will be set at the beginning of the semester where all course necessary material will be posted including course notes, homework assignments and solutions, available computational software tools and manuals.

Relationship of course objectives to IDDP Program outcomes	
Program Outcome	Demonstrate appropriate depth and breadth of knowledge that is at the frontier of their disciplines
Program Outcome	Use skills of interdisciplinary scholarship and research to integrate multiple perspectives
Program Outcome	Work effectively in a multidisciplinary collaborative environment using highly developed cognitive and creative expert skills and intellectual independence
Program Outcome	Communicate effectively, in written and oral forms, their research results and/or critique highly complex and diverse matters to diverse audiences.