Course Package

Molecular Science

Name module	Molecular Science - 1A
Educational programme	MSc Chemical Engineering
Period	First block of first semester (block 1A)
Study load	15 ECTS
Coordinator	C. C. Diepenmaat

Molecular Science			
block 1A	**block 1B**	**block 2A**	**block 2B**
AMM Molecular & Biomolecular CT **193700020** (5 EC)			
AMM Characterization **193700010** (5 EC)			
Advanced Colloids and Interfaces **201800083** (5 EC)			

Required preliminary knowledge: To do this course package you need to have completed at least the first two years of your BSc. Basic knowledge of Catalysis and Kinetic, Basics of Physical Chemistry, Organic and Inorganic Chemistry, Molecular Biology, Basic knowledge of Thermodynamics, materials science and molecular biology.

193700020 - AMM - Molecular and Biomolecular Chem. and Techn.

1. Noncovalent interactions, development of supramolecular chemistry (incl. the Excel modeling of thermodynamec equilibria)
2. Synthetic host-guest chemistry I: cation-binding hosts
3. Synthetic host-guest chemistry II: binding of guests in solution
4. Molecular recognition in biological systems, enzyme catalysis
5. Sensor concepts and sensor devices
6. Cooperativity: molecular and biomolecular (e.g. hemoglobin) examples
7. Multivalency: effective molarity concept, cyclization, cell membrane recognition
8. Polyvalent systems I: macromolecular assembly + supramolecular polymers
9. Polyvalent systems II: coordination polymers, MOFs
10. Polyvalent systems III: proteins an protein folding
11. Polyvalent systems IV: virus assembly

The modules are tentative and subject to change. Please check the website regularly.

12. Polyvalent systems V: DNA + artificial DNA constructs
13. Polyvalent systems VI: layer-by-layer assembly
14. Polyvalent systems VII: supramolecular materials

193700010 - AMM Characterization

In this module a palette of state-of-the-art characterization techniques to investigate structure and properties of nanostructures will be introduced and applied. The module consists of 3 courses: Surface characterization (35 %), X-ray diffraction (30 %) and Microscopy and Spectroscopy (35 %). Recent publications on metal halide perovskite photovoltaics will be used as case study to illustrate the potential and complementarity of all techniques discussed in this module.

201800083 - Advanced Colloids and Interfaces

Description of colloids, surfaces and interfaces. All kinds of interfaces between different phases are treated. Thermodynamic descriptions of these interfaces are deduced. Several techniques for characterizing interfaces are discussed. During contact hours, the contents of will be presented and discussed, and exercises will be made and discussed. For each topic, a case assignment will be offered. Topics include:

- Lifshitz-van der Waals Interactions
- Polar/Acid-Base Interactions
- Wetting and Contact Angles
- Electrostatics
- DLVO and XDLVO interaction
- Electrokinetic Phenomena
- Electrostatic and Polymeric Stabilization of Colloids
- Colloidal Phenomena (Marangoni-Effect, Ouzo effect, etc.)