CHEM3052: CHEMISTRY BEYOND THE MOLECULE: SUPRAMOLECULAR CHEMISTRY

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Chemistry beyond the Molecule: Supramolecular Chemistry

Subject Code
CHEM - Chemistry
Course Number
3052

Academic Unit
Chemistry (CHEM)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
CHEM2006/BCH2006 Principles of Inorganic Chemistry
CHEM2007/BCH2007 Principles of Organic Chemistry

Precursors
Nil

Equivalent Courses
BCH3052 Chemistry Beyond the Molecule: Supramolecular Chemistry

Exclusive Courses
Nil

Part II Course Details

Abstract

This course will introduce students to the basic concepts of host-guest (supramolecular) chemistry and molecular recognition. The course will build from fundamental knowledge in organic and inorganic chemistry to illustrate the relationship between these topics and supramolecular chemistry. In this course, students will use relevant chemical concepts to analyze aspects of supramolecular chemistry and their applications, and current examples will be used. The skills and understanding accumulated during this course will prepare students for studies in advanced supramolecular chemistry.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the major types of supramolecular interactions, and apply relevant chemical concepts to explain the nature and origins of these interactions.	15	x		
2	Describe, identify and compare the nature, synthesis, supramolecular interactions and applications of host molecules and receptors.	30	x		
3	Based on the nature and chemical features of a supramolecular species, apply concepts (CILO 1) to rationalize its reactivity and behavior.	25	x	x	
4	Based on the analysis of a series of host molecules, identify and hypothesize the trends in reactivity and binding of guests.	20	x	x	x
5	Analyze research on supramolecular chemistry in the current literature, apply relevant concepts and knowledge, and discuss findings using a presentation.	10	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures, two-way questioning and tutorials	By engaging in lectures, two-way questioning and tutorials, students will learn to recognize the basic concepts and interactions and give them practice in explaining these to peers. Moreover, each student will individually use interactive software to visualize (in 3-D) the host molecules, in order to help them identify the interactions and geometry and improve their interpretation skills.	1	
2	Lectures and online teaching material	By engaging in lectures and online teaching material (videos and websites), students will acquire knowledge regarding nature and applications of important host molecules, in order to draw comparisons.	2	
3	Problem-solving activities and interactive tutorials	By engaging in problem-solving activities and interactive tutorials, students will gain experience in critically evaluating the nature and chemical features of supramolecular species, in order to predict their reactivity and behavior.	3	
4	Problem-based tutorials and assignments	From step-by-step problem-based tutorials and assignments (with timely model answers), students will learn to practice the technique to analyze the host molecules. This will be facilitated by the use of interactive software for visualization in 3-D.	4	

5	Literature research	Students will peruse and examine the current literature research on supramolecular chemistry, and practice explaining relevant concepts and findings to peers.	5	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tutorials & Assignments	1, 2, 3, 4	20	
2	Presentation	5	10	

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Additional Information for ATs

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM: "A minimum of 40% in both coursework and examination components."

Assessment Rubrics (AR)

Assessment Task

Tutorial & Assignments

Criterion

Demonstration of understanding the principles and practice of various topics of supramolecular chemistry.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics of supramolecular chemistry.

Good (B+, B, B-)

Able to describe and explain the principles of various topics of supramolecular chemistry.

Fair (C+, C, C-)

Able to describe and explain some key principles of various topics of supramolecular chemistry.

Marginal (D)

Able to briefly describe isolated principles of various topics of supramolecular chemistry.

Failure (F)

Fail to accurately describe and explain relevant principles of any topics in supramolecular chemistry.

Assessment Task

Presentation

Criterion

Demonstration of understanding the principles and practice of various topics of supramolecular chemistry, and the ability to present those principles and practice in concise, orderly and professional manner.

Excellent (A+, A, A-)

Able to deliver fluent and well organized presentations to demonstrate excellent understanding of the principles and practice of various topics of supramolecular chemistry.

Good (B+, B, B-)

Able to deliver fluent presentations, with evidence of proper preparation, to describe and explain the principles of various topics of supramolecular chemistry.

Fair (C+, C, C-)

Able to deliver presentations, with evidence of proper preparation, to describe and explain some key principles of various topics of supramolecular chemistry.

Marginal (D)

Able to deliver comprehensible presentations to briefly describe isolated principles of various topics of supramolecular chemistry.

Failure (F)

Fail to present relevant principles of any topics in supramolecular chemistry in coherent and comprehensible manners.

Assessment Task

Examination

Criterion

Demonstration of understanding the principles and practice of various topics of supramolecular chemistry.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics of supramolecular chemistry.

Good (B+, B, B-)

Able to describe and explain the principles of various topics of supramolecular chemistry.

Fair (C+, C, C-)

Able to describe and explain some key principles of various topics of supramolecular chemistry.

Marginal (D)

Able to briefly describe isolated principles of various topics of supramolecular chemistry.

Failure (F)

Fail to accurately describe and explain relevant principles of any topics in supramolecular chemistry.

Part III Other Information

Keyword Syllabus

Lock-and-Key Principle
Hydrogen Bonding and Intermolecular Bonds
Molecular Recognition
Chelate, Conformational and Macrocyclic Effects

Ionic Recognition: Cation- and Anion-Binding Hosts
Selectivity in Host Molecules
Preparation of Synthetic Host Molecules
Natural Host Molecules
Self-Assembly
Applications of Supramolecular Chemistry

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	"Core Concepts in Supramolecular Chemistry and Nanochemistry", Jonathan W. Steed, David R. Turner, Karl Wallace, Wiley, 2007 (ISBN: 978-0-470-85867-7).
2	"Supramolecular Chemistry", Jonathan W. Steed, Jerry L. Atwood, Wiley, 2000 (ISBN: 978-0-471-98791-8).
3	"Supramolecular Chemistry : An Introduction", Fritz Vogtle, Wiley, 1991 (ISBN: 047192802X).
4	Online Resources: www.uni-saarland.de/fak8/schneider/ (under “Supramolecular Structures”)This enables visualization of some host molecules. Please first install the MDL Chime plug-in (www.mdl.com/products/framework/chime).