CHEM8016: SOLID STATE ANALYSIS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Solid State Analysis

Subject Code
CHEM - Chemistry
Course Number
8016

Academic Unit
Chemistry (CHEM)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course provides students the principles and applications of some widely used instruments in materials chemistry. The course will focus on the understanding of the working principles, advantages and limitations of different instruments in the characterization of compositions, morphologies and electronic properties of materials.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Evaluate the working principles of advanced instruments in the characterization of composition, morphologies and electronic properties of materials including XPS, SEM, TEM, and XAS.		x		
2	Evaluate the advantages and limitations of the instruments in characterization in comparison to the traditional instruments such as elemental combustion and optical microscope.		x		
3	Interpret and analyse the data. Extrapolate compositional and structural information from data and correlate with materials performance.		x	x	x
4	Critically evaluate various characterization techniques and rationally select appropriate instruments for characterizations in research.		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 (Fundamental)	Students will learn the physical principles and design principles of instrument.	1, 2	
2	Lectures (Case Study)	Students will review data in literatures, understand the data interpretation and the correlation between structure and performance.	1, 2, 3, 4	

3	Presentation and Report	Students will select a new technique for materials characterization, starting from the principles and instrumentation to applications.	1, 2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Presentations	1, 2, 3, 4	20	-	Yes
2	Reports	1, 2, 3, 4	20	-	Yes
3	Examination	1, 2, 3, 4	0	-	No

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

Minimum Continuous Assessment Passing Requirement (%)

40

Minimum Examination Passing Requirement (%)

40

Assessment Rubrics (AR)

Assessment Task

Presentations (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Demonstration of understanding the principles and practice of the selected characterization technique.

Excellent

(A+, A, A-) Excellent organization of the content and presentation skills; Excellent explanation of the selected instrument design principle with data.

Good

(B+, B, B-) Good organization of the content and presentation skills; Good explanation of the selected instrument design principle with data.

Fair

(C+, C, C-) Moderate organization of the content and presentation skills; Moderate explanation of the selected instrument design principle with data.

Marginal

(D) Basic organization of the content and presentation skills; Basic explanation of the selected instrument design principle with data.

Failure

(F) Not even reaching marginal levels

Assessment Task

Reports (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Demonstration of understanding the principles and practice of the selected characterization technique.

Excellent

(A+, A, A-) Excellent organization of the content and writing skills; Excellent explanation of the selected instrument design principle with data.

Good

(B+, B, B-) Good organization of the content and writing skills; Good explanation of the selected instrument design principle with data.

Fair

(C+, C, C-) Moderate organization of the content and writing skills; Moderate explanation of the selected instrument design principle with data.

Marginal

(D) Basic organization of the content and writing skills; Basic explanation of the selected instrument design principle with data.

Failure

(F) Not even reaching marginal levels

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Demonstration of understanding the principles and practice of various advanced instruments for materials characterization.

Excellent

(A+, A, A-) High ability to understand the instrument design principle and analyse the data; High ability to select appropriate instrument for structural characterization

Good

(B+, B, B-) Good ability to understand the instrument design principle and analyse the data; Good ability to select appropriate instrument for structural characterization

Fair

(C+, C, C-) Moderate ability to understand the instrument design principle and analyse the data; Moderate ability to select appropriate instrument for structural characterization

Marginal

(D) Basic ability to understand the instrument design principle and analyse the data; Basic ability to select appropriate instrument for structural characterization

Failure

(F) Not even reaching marginal levels

Assessment Task

Presentations (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Demonstration of understanding the principles and practice of the selected characterization technique.

Excellent

(A+, A, A-) Excellent organization of the content and presentation skills; Excellent explanation of the selected instrument design principle with data.

Good

(B+, B) Good organization of the content and presentation skills; Good explanation of the selected instrument design principle with data.

Marginal

(B-, C+, C) Basic organization of the content and presentation skills; Basic explanation of the selected instrument design principle with data.

Failure

(F) Not even reaching marginal levels

Assessment Task

Reports (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Demonstration of understanding the principles and practice of the selected characterization technique.

Excellent

(A+, A, A-) Excellent organization of the content and writing skills; Excellent explanation of the selected instrument design principle with data.

Good

(B+, B) Good organization of the content and writing skills; Good explanation of the selected instrument design principle with data.

Marginal

(B-, C+, C) Basic organization of the content and writing skills; Basic explanation of the selected instrument design principle with data.

Failure

(F) Not even reaching marginal levels

Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Demonstration of understanding the principles and practice of various advanced instruments for materials characterization.

Excellent

(A+, A, A-) High ability to understand the instrument design principle and analyse the data; High ability to select appropriate instrument for structural characterization

Good

(B+, B) Good ability to understand the instrument design principle and analyse the data; Good ability to select appropriate instrument for structural characterization

Marginal

(B-, C+, C) Basic ability to understand the instrument design principle and analyse the data; Basic ability to select appropriate instrument for structural characterization

Failure

(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Materials characterization, elemental composition, surface morphology, electronic structure, X-ray spectroscopy, electron microscope

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	L. Reimer, "Scanning Electron Microscope", 2nd Ed., Springer-Verlag, 1998
2	D. Koningsberger & R. Prins, "X-ray Absorption Spectroscopy: Principles, Applications and Techniques of EXAFS, SEXAFS and XANES", Wiley, 1988
3	John F. Moulder, "Handbook of X-ray Photoelectron Spectroscopy", Perkin-Elmer Corp. 1992
4	Frans D. Tichelaar, "Transmission Electron Microscopy as Nanolab", Wiley, 2012