# CHEM8142: PHOTOCHEMISTRY

**Effective Term**
Semester A 2025/26

## Part I Course Overview

**Course Title**
Photochemistry

**Subject Code**
CHEM - Chemistry
**Course Number**
8142

**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**
BCH8142 Photochemistry

**Exclusive Courses**
Nil

## Part II Course Details

**Abstract**
This course is a postgraduate taught course tailored for postgraduate research students only.
In this course students will:

- explore and apply the basic principles of photochemistry;
- analyze and interpret photoeffects of coordination chemistry;
- identify and apply the photochemical reactions of certain classes of organic compounds;
- explain examples of the effects of photochemistry in nature and in various applications.

**Course Intended Learning Outcomes (CILOs)**

| | CILOs | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|---|---|---|---|---|---|
| 1 | Demonstrate an understanding of excited states and apply group theory to photochemical problems | 20 | x | | |
| 2 | Explain natural and anthropogenically derived photochemical phenomena | 20 | x | x | |
| 3 | Describe and apply photochemical reactions of certain homologous series of organic compounds | 20 | x | x | |
| 4 | Analyze, discuss, conduct and defend their own investigation into a photochemical phenomenon | 20 | | x | x |
| 5 | Critically evaluate photochemical theories and literature | 20 | | 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 | Group activities | Students will learn through large group activities exploring problems and calculations in photochemistry | 1 | |
| 2 | Lectures, videos and web-based teaching methods | Lectures, videos and web-based teaching methods will enable students to develop experience in recognizing and explaining natural and anthropogenically derived photochemical phenomena | 2 | |

| | | | | |
|---|---|---|---|---|
| 3 | Group activities and tutorials | Large and small group interactive questioning and tutorials will provide opportunities for students to select and apply photochemical reactions of certain homologous series | 3 | |
| 4 | Oral presentations | Student-centred learning and student oral presentations will form the basis for this activity where a specific aspect of photochemistry is explored in detail | 4 | |
| 5 | Literature review | Students will independently review current theories and experiments in photochemistry critically and both give and receive feedback based these insights from the current literature | 5 | |

**Assessment Tasks / Activities (ATs)**

| | ATs | CILO No. | Weighting (%) | Remarks ("-" for nil entry) | Allow Use of GenAI? |
|---|---|---|---|---|---|
| 1 | Assignment | 4 | 5 | - | Yes |
| 2 | Short Tests | 1, 2, 3 | 10 | - | Yes |
| 3 | Presentation | 4 | 15 | - | Yes |

**Continuous Assessment (%)**

30

**Examination (%)**

70

**Examination Duration (Hours)**

3

**Minimum Continuous Assessment Passing Requirement (%)**

40

**Minimum Examination Passing Requirement (%)**

40

**Assessment Rubrics (AR)**

**Assessment Task**

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

**Criterion**

Ability to analyse and solve problems relevant to photochemistry

**Excellent**
(A+, A, A-) High

**Good**
(B+, B, B-) Significant

**Fair**
(C+, C, C-) Moderate

**Marginal**
(D) Basic

**Failure**
(F) Not even reaching marginal levels

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**Assessment Task**
Short Tests (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**
Ability to analyse and solve problems relevant to photochemistry

**Excellent**
(A+, A, A-) High

**Good**
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**Fair**
(C+, C, C-) Moderate

**Marginal**
(D) Basic

**Failure**
(F) Not even reaching marginal levels

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**Assessment Task**
Presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**
Ability to analyze, discuss, conduct and defend their own investigation into a photochemical phenomenon

**Excellent**
(A+, A, A-) High

**Good**
(B+, B, B-) Significant

**Fair**
(C+, C, C-) Moderate

**Marginal**
(D) Basic

**Failure**
(F) Not even reaching marginal levels

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

**Criterion**
Ability to demonstrate an understanding of excited states and apply group theory to photochemical problems, to explain natural and anthropogenically derived photochemical phenomena, and to describe and apply photochemical reactions of certain homologous series of organic compounds

**Excellent**
(A+, A, A-) High

**Good**
(B+, B, B-) Significant

**Fair**
(C+, C, C-) Moderate

**Marginal**
(D) Basic

**Failure**
(F) Not even reaching marginal levels

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**Assessment Task**
Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**
Ability to analyse and solve problems relevant to photochemistry

**Excellent**
(A+, A, A-) High

**Good**
(B+, B) Significant

**Marginal**
(B-, C+, C) Basic

**Failure**
(F) Not even reaching marginal levels

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**Assessment Task**
Short Tests (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**
Ability to analyse and solve problems relevant to photochemistry

**Excellent**
(A+, A, A-) High

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**Assessment Task**
Presentation (for students admitted from Semester A 2022/23 to Summer Term 2024)

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

**Criterion**
Ability to demonstrate an understanding of excited states and apply group theory to photochemical problems, to explain natural and anthropogenically derived photochemical phenomena, and to describe and apply photochemical reactions of certain homologous series of organic compounds

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(A+, A, A-) High

**Good**
(B+, B) Significant

**Marginal**
(B-, C+, C) Basic

**Failure**
(F) Not even reaching marginal levels

# Part III Other Information

**Keyword Syllabus**

Basic principles of photochemistry: photophysical processes and photodissociation. Absorption and emission of radiation. Nature of color.

Photochemical reactions of organic compounds.

Photochemistry and spectroscopy of transition metals and rare earths. Charge transfer photochemistry. Molecular emission. Energy transfer processes.

Kinetics of photophysical processes. Reactions of excited species: photochemical reactions. Techniques in photochemistry.

Lasers. Optical materials.

Atmospheric photochemistry. Photosynthesis.

Vision. Photoimaging. Photochromism and chemiluminescence. Solar energy storage. Photopolymerisation. Supramolecular photochemistry: photomolecular devices. Photomedicine.

**Reading List**

**Additional Readings**

| | Title |
|---|---|
| 1 | Photochemistry, C.E. Wayne and R.P. Wayne. Oxford University Press. New York,1996. |
| 2 | Principles and Applications of Photochemistry, R.P. Wayne. Oxford University Press. New York, 1988. |
| 3 | Supramolecular Photochemistry, Ed. Vincenzo Balzani, NATO ASI Series. Reidel, Dordrecht, 1987. |
| 4 | Elements of Inorganic Photochemistry, G.J. Ferraudi. Wiley. Canada,1988. |
| 5 | Principles of Photochemistry. J.A. Barltrop and J.D. Coyle. Wiley. New York, 1978. |
| 6 | Surface Photochemistry. ed. M. Anpo. Wiley, 1996. |
| 7 | Introduction to Organic Photochemistry. J.D. Coyle. Wiley, 1998. |
| 8 | Photochemistry and Photophysics of metal complexes. D.M. Roundhill. Plenum, New York, 1994. |
| 9 | The Physics and Chemistry of Colour, K. Nassau. Wiley, 2001. |
| 10 | Lasers in Chemistry, D.L. Andrews. Springer-Verlag, 1986. |
| 11 | Modern Molecular Photochemistry, N.J. Turro. University Science Books, Mill Valley, California, USA, 1991. |