# Course Specification
## (Bachelor)

| | |
|---|---|
| **Course Title:** | Stereochemistry |
| **Course Code:** | CEM 333 |
| **Program:** | Chemistry |
| **Department:** | Chemistry |
| **College:** | Science |
| **Institution:** | Majmaah University |
| **Version:** | TP -153 |
| **Last Revision Date:** | 15 December 2024 |

## Table of Contents

## A. General information about the course:

### 1. Course Identification

| | | | | | |
|---|---|---|---|---|---|
| **1. Credit hours: ( 2 )** | | | | | |
| **2. Course type** | | | | | |
| **A.** | ☐University | ☐College | ☒Department | ☐Track | ☐Others |
| **B.** | ☒Required | | ☐Elective | | |
| **3. Level/year at which this course is offered: ( 5th level- third year )** | | | | | |
| **4. Course General Description:** | | | | | |
| Stereochemistry the branch of chemistry concerned with the three dimensional aspects of molecules. The chemical studies take into account the spatial aspects of molecules.<br>Stereochemistry course introduce the fundamental principles in all aspects of stereochemistry. This concise resource is generously enriched with numerous worked examples.<br>The course provide definitions of terms such as chirality, enantiomers, diastereoisomers and racemisation, complete with suitable examples to illustrate key concepts. The use of a polarimeter and associated definitions ar described, together with two different conventions D, L and R, S for specification of configuration. The distinction between conformation and configuration<br>This course explains how the different properties of stereoisomers of a compound arise, and what processes can be used to prepare and analyze stereoisomerically pure compounds. | | | | | |
| **5. Pre-requirements for this course (if any):** | | | | | |
| CEM231 | | | | | |
| **6. Co-requisites for this course (if any):** | | | | | |
| None | | | | | |
| **7. Course Main Objective(s):** | | | | | |
| • Explore the field of stereochemistry, including nomenclature, analytical techniques, asymmetric syntheses and real-world applications.<br>• Provide fundamental principles in all aspects of stereochemistry. This concise resource is generously enriched with numerous worked examples.<br>• Explains how the different properties of stereoisomers of a compound arise, and what processes can be used to prepare and analyze | | | | | |

- Apply various concepts of stereochemistry and fundamental principles of stereoselectivity in organic chemistry

## 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | Traditional classroom | 30 | 100% |
| 2 | E-learning | | - |
| 3 | Hybrid<br>• Traditional classroom<br>• E-learning | | - |
| 4 | Distance learning | | - |

## 3. Contact Hours (based on the academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1. | **Lectures** | 30 |
| 2. | **Laboratory/Studio** | - |
| 3. | **Field** | - |
| 4. | **Tutorial** | - |
| 5. | **Others (specify)** | - |
| **Total** | | |

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Code of PLOs aligned with the program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| **1.0** | **Knowledge and understanding** | | | |
| 1.1 | Recognize the stereochemistry of organic compounds, and the different types of isomerism | **K1** | Formal lectures, Effective Learning Collaborative Learning | Standardized exam Laboratory examination - Class exercises |

| Code | Course Learning Outcomes | Code of PLOs aligned with the program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| | | | | - Evaluation of research |
| **2.0** | **Skills** | | | |
| 2.1 | Communicate effectively orally and written using appropriate presentation formats for different issues with recipients of different types | **S2** | Formal lectures, Effective Learning Collaborative Learning Team-based learning | Standardized exam Laboratory examination - Class exercises - Evaluation of research |
| 2.2 | Design the organic isomer effective Stereoisomers and conformational Stereoisomers using models and technology | **S3** | | |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| 3.1 | Demonstrate the ability of working independently and with groups | **V3** | Interactive learning Cooperative learning | Performance appraisal Behavioral observation Assessment of Reports Assessment of Group presentations Indirect assessment |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1. | Introduction to stereochemistry of organic compounds, Different types of isomerism in organic compounds, Isomerism: Constitutional Isomers | 2 |

| | | |
|---|---|---|
| | and Stereoisomers, Chirality and Stereochemistry, Importance of stereochemistry in real life: some examples | |
| 2. | Constitution and Configuration; Chemistry in 3D space Chirality and its origin, Molecules Having One Chirality Center are Chiral symmetry criterion | 2 |
| 3. | Enantiomers and Chiral Molecules Structure of Enantiomers Nomenclature for Enantiomers (Speciation of Absolute Configuration) R/S Nomenclature system (Cahn–Ingold–Prelog convention) Chemical Properties of Enantiomers,Physical Properties of Enantiomers | 4 |
| 4. | Properties of Enantiomers: Optical activity, the origin of optical activity, Polarimeter, Clockwise Dextrorotatory (+),Counterclockwise Levorotatory (-),Enantiomers can Plane Polarized Light Racemization, Formation of racemic mixtures,Enantiomeric Excess, Methods for determining enantiomeric excess , The Biological Importance of Enantiomers | 4 |
| 5. | Molecules with More than One Chirality Center, Number of Stereoisomers, Meso Compound. | 2 |
| 6. | Diastereomers, Properties of Diastereomers ,Geometric isomerism ,spatial selectivity in certain organic Reactions, Stereoisomerism of Cyclic Compounds, Identification of Asymmetric Carbons in Cyclic Compounds. | 4 |
| 7. | Fisher and Newman projection of stereo compounds, Fischer Projection Formulas, Assigning R,S Configuration to Fischer Projections, Naming from the Fischer Projection Draw the sterocompounds in2D , Newmann and the conformation of alkane | 4 |
| 8. | Stereoelectronic and steric principles in reactions: Substitution, elimination and addition; selectivity and specificity. | 4 |
| 9. | Conformations of acyclic molecules conformational isomerism, Ethane , Propane, Butane conformations, structural. Conformations of cyclic alkanes and their derivatives Stereoisomers, conformers, conformations of cyclohexane Rings, Cyclohexane The chair conformation, The boat conformation,The twist boat conformation,Interconversion of cyclohexane conformations. | 4 |
| --- | | |
| **Total** | | **30** |

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | Homework, exercises, periodic tests , Essays, project , Presentation | During the semester | 20% |
| 2. | Mid term 1 | 6th week | 15% |
| 3. | Mid term 2 | 11th week | 15% |
| 4. | Electronic exam | 12th week | 10% |
| 5. | Final exam | End of semester | 40% |

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

## E. Learning Resources and Facilities

### 1. References and Learning Resources

| | |
|---|---|
| **Essential References** | Ranjit S. Dhillon 2014. Stereochemistry, Alpha, Science Intl Ltd |
| **Supportive References** | T. W. Graham Solomons , Craig B. Fryhle , Scott A. Snyder . Organic Chemistry 12th Edition 2017. |
| **Electronic Materials** | https://www.khanacademy.org/science/organic-chemistry/stereochemistry-topic<br>https://www.researchgate.net/publication/261991150_Stereochemistry |
| **Other Learning Materials** | ChemDraw Professional 17.0 Suite<br>ACD/ChemSketch :: Draw Chemical Structures :: ACD/Labs<br>https://chemaxon.com/marvin |

### 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities**<br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | Class room, laboratory of Organic chemistry |
| **Technology equipment**<br>(projector, smart board, software) | The electronic platform, data show, Smart Board |
| **Other equipment**<br>(depending on the nature of the specialty) | |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | Students | Student evaluation (electronically questionnaire) organized by the University |
| Effectiveness of Students assessment | Department | Analysis of electronically questionnaire. the Make decision through department Council |
| Quality of learning resources | Department / staff members | Analysis of course report by Chemistry Department Council |
| The extent to which CLOs have been achieved | Department Faculty | CLO Analysis Report |
| Other | | |

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval

| | | |
|---|---|---|
| **COUNCIL /COMMITTEE** | Chemistry Department Council | |
| **REFERENCE NO.** | **1** | |
| **DATE** | **14/6/1446 H** | **15/12/2024** |