Course Specification

(Postgraduate Programs)

Course Title:	**Stereoselectivity Synthesis**
Course Code:	**CHM 6124**
Program:	**Master of science in chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	: Imam Mohammad Ibn Saud Islamic University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (.....)				
3 (3 Lectures, 0 Lab, 0 Tutorials)				
2. Course type				
A.	☐University	☐College	☐Department	☐Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (Level 2/ Year 1)				
4. Course General Description:				
This course is designed to provide an advanced understanding of structure and stereoisomers, configuration, and stereochemistry of alkenes. The course will extend to cover conformation of cyclic and acyclic molecules, and Stereoselectivity Synthesis. This part will dedicated to Terminology, Stereoselective Synthesis, Categories of Stereoselective Synthesis, Stereoselective Catalytic Reductions, Homogeneous and Heterogeneous Catalytic Reductions, Stereoselective Non-Catalytic Reductions, Enantioselective Non-Catalytic Reductions, and others of interest in this topics.				
5. Pre-requirements for this course (if any):				
Advanced Organic Chemistry – CHM 6121				
6. Pre-requirements for this course (if any):				
None				
7. Course Main Objective(s):				

- **Use spectroscopic equipment such as IR, NMR (1H and 13C) in all techniques used, MS. Spectrometers.**
- **• Identify organic compounds by analysis and interpretation of spectral data.**
- **• Analyze and interpret One- Dimensional NMR (1H and 13C), and Two-Dimensional NMR spectra and relevant techniques used.**
- **• Investigate and determine the structure of typical organic chemical compounds using mass spectroscopy supported by NMR (1H and 13C), and IR.**
- **• Perform the most commonly mass spectroscopy analysis and fragmentation process in Electron Ionization Mass Spectrometry, and to interpret and the result.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

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

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)……**	0
	Total	45

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	To recall stereoisomers symmetry and configurations of organic compounds.	K1. *Org.*; K2. *Org.*; K4. *Org.*	▪Five lectures. ▪Self-study Home-exam	▪ Regular Exams ▪ Assignments ▪ Short Quizzes ▪ Oral Discussion Participation.
1.2	To outline stereochemistry of alkenes and conformation of acyclic and Cyclic Organic Molecules.	K2. *Org.*; K4. *Org*	▪ Five hours/week lectures. ▪ Think and justify stereochemistry of alkenes acyclic and cyclic confirmation, using available references (SDL) online. Open discussion.	▪ Oral Discussion marks ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	To list Categories and principles of Stereoselective Synthesis.	K2. *Org.*; K3. *Org.*; K4. *Org*	▪ Five hours/week lectures. Group Discussion using available references (SDL).	▪ Midterm. ▪ Assignments. ▪ Group Discussions. ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.
1.4	To state Stereo-selective synthesis of Simple Organic Compounds.	K3. *Org.*; K4. *Org*	▪ Five hours/week lectures. Group Discussion using available references (SDL).	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
2.0	**Skills**			
2.1	To analyze problems and explore strategies for a suitable solution, justifying the optimum approaches to appropriate Stereoselective Synthesis.	S1. *Org.*; S2. *Org.*; S3. *Org.*	▪ Lectures activity. ▪ Self-study Deep discussion on appropriate strategies for stereo-selective synthesis.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Open Discussions. ▪ Participation Mini -seminar.
2.2	To interpret Stereochemical information for isolated reaction product leading to predict and postulate the Stereoselectivity Synthesis mechanism.	S2. *Org.*; S3. *Org*	▪Practice some stereoselective synthesis examples by proposing the reaction mechanism achieving. ▪Brainstorming. Self-study.	▪ Questions in Lectures. ▪ Participation ▪ Oral Discussion Short Quizzes
2.3	To justify the methods for selective synthesis of organic compounds containing Stereogenic Elements.	S1. *Org.*; S2. *Org*; S3. *Org*	▪ Lectures ▪ Oral Discussions. ▪ Brainstorming. Self-study.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Oral Discussion. Participation.
2.4	To demonstrate Oral Communication for Stereochemistry and all aspects for	S1. *Org.*; S3. *Org*; S4. *Org.*	▪ Group Discussion and Assignments ▪ Introduce several examples for some	▪ Oral Discussion. ▪ Quizzes, and Exams.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	Stereoselective Synthesis, and its applications, accompanying writing of mini- Reports, operating electronic mail, and Network in communicating with others.		organic compounds synthesized by stereoselective synthesis, which will require reading, writing, and oral presentation. Encourage students to use electronic mail to submit Home Exams and Assignments.	▪ Giving marks for Oral Discussion in Lectures. ▪ Marks given for Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	To perform a scientific presentation, research, and work independently and integrate with a collaborated group, Using IT to acquire, analyze, and communicate information.	V1. *Org.*; V2. *Org.*	**To perform a scientific presentation, research, and work independently and integrate with a collaborated group, Using IT to acquire, analyze, and communicate information.**	▪ Brainstorming. ▪ Exercises ▪ Group Discussion. ▪ Team work.
3.2	To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently	V1. *Org.*; V2. *Org.*	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently**	▪ Small Group tasks ▪ Open discussion at classroom. ▪ Office hour guiding. Group Presentation of mini-projects.
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	***Introduction and Structure:*** Scope, Polarimetry and Optical Rotation, Constitution, Configuration, Conformation, Determination of Structure,	4

	Molecular Models. Stereoisomers: Nature of Stereoisomers, Enantiomers, Diasteriomers	
2.	***Stereoisomers:*** Nature of Stereoisomers, Enantiomers, Diasteriomers.	**4**
3.	***Symmetry:*** Symmetry of Elements, Symmetry Operators, Point Groups Cntaining Chiral Molecules, Point Groups Containing Only Achiral Molecules, Desymmetrization, Symmetry and Molecular Properties.	**8**
4.	***Configuration:*** Definitions, Relative and Absolute Configuration, Absolute Configuration and Notation, Determination of Relative Configuration of Saturated Aliphatic Compounds.	**6**
5.	***Stereochemistry of Alkenes:*** Structure of Alkenes. Nature of cis-trans Isomerism, Determination of Configuration of cis-trans, Interconversion of cis-trans Isomers.	**6**
6.	***Conformation of Acyclic Molecules:*** Conformation of Ethane, Butane and other Simple Saturated Acyclic Molecules, Conformation of Acyclic and Miscellaneous Compounds.	**6**
7.	***Conformation of Cyclic Molecules:*** Stereisomerism and Configuration Nomenclture of Ring Compounds, Stability of Cyclic Molecules, Conformational Aspects of The Chemistry of Six Membered Ring Compounds, Stereochemistry of Ring Compounds Other Than Six Membered Ring, Stereochemistry of Fused, Bridged and Caged Ring Systems .	**3**
8.	***Stereoselective Synthesis:*** Terminology, Stereoselective Synthesis, Categories of Stereoselective Synthesis, Stereoselective Catalytic Reductions, Homogeneous and Heterogeneous Catalytic Reductions, Stereoselective Non-Catalytic Reductions, Enantioselective Non-Catalytic Reductions, Diastereoselective Non-Catalytic Reductions, Stereoselective Carbon-Carbon Bond Forming Reactions, Nucleophilic Additions to Aldehydes and Ketones, Asymmetric Catalytic Hydro-carbonylations, Asymmetric Aldol Reactions, Asymmetric Alkylation Reactions, Asymmetric Carbon-Heteroatom Bond Formations, Carbon-Oxygen Bond Formation, Carbon-Nitrogen Bond Formation, Carbon Sulfur Bond Formation, Stereoselective C-H Bond Formation and Proton Migration.	**8**
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Class Activities (Open Discussion, Mini-reports, Oral Presentation, solving questions)**	**weekly**	**30 %**
2.	**Midterm Exam**	**9 th week**	**30 %**
3.	**Final Exam**	**Around 17th week**	**40 %**

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
...	**Total**		**100%**

*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	***Stereochemistry of Organic Compounds,*** E. L. Eliel, S. H. Wilen, 1st Ed., Wiley-Interscience, (1994), ISBN-13: 978-0471016700. ***Selectivity in Organic Synthesis,*** R. S. Ward. Wiley-VCH; (1999), ISBN: 978-0-471-98778-9. ***Classics in Stereoselective Synthesis;*** E. M. Carreira, L. Kvaerno 1st Ed., Wiley-VCH, (2009). ISBN-13: 978-3527299669
Supportive References	***Stereoselective Synthesis in Organic Chemistry***, Atta-ur-Rahman, Z. Shah, , Springer- Verlag, (1993), ISBN 978-1-4613-8327-7
Electronic Materials	• Journal of Organic Chemistry, ACS • Organic Letters, ACS • Tetrahedron • Tetrahedron Letters • Tetrahedron • Tetrahedron Asymmetry • Organic and Biomolecules Chemistry, RSC • European Journal Of Organic Chemistry Saudi Digital Library
Other Learning Materials	• Blackboard Multimedia associated with the text book and the relevant websites.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology equipment (Projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other equipment (Depending on the nature of the specialty)	**None**

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
	Students	**Direct:** Questionnaire.

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of students' assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory-GCC)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	
The extent to which CLOs have been achieved	Students	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**Council of Chemistry Department**
REFERENCE NO.	**10 (No. 2/10)**
DATE	**21/04/1444- 15/11/2022**