هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Sustainable Chemistry
Course Code:	ICHM353-2
Program:	Bachelor of Science in Industrial Chemistry
Department:	Department of Physical Sciences
College:	College of Science
Institution:	Jazan University
Version:	TP-153 (2024)
Last Revision Date:	01/03/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 hrs.)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐ Elective		

3. Level/year at which this course is offered: (6th Level--- 3rd Year.)

4. Course general Description:

Course title	Course code	Contact Hours			Credit Hours	Year	Level	Prerequisite	Corequisite
		Lec	Tut	Lab					
Sustainable Chemistry	ICHM353-2	2	-	-	2	3rd	6th	ICHM251-3	--

The course provides the student with the principles of sustainable chemistry, also known as green chemistry, and will equip the students with an understanding of how to assess chemical syntheses and processing routes as well as to design sustainable materials and chemicals, study of fuels and their safe alternatives, and some environmental problems related to industrial waste, and future issues: renewable energy and recycling.

5. Pre-requirements for this course (if any):

ICHM251-3

6. Co-requisites for this course (if any):

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7. Course Main Objective(s):

1. **To learn the fundamentals and the latest developments in sustainable chemistry.**
2. **To understand why solvent replacements are being sought.**
3. **To familiarize with different green reaction alternatives of conventional reaction procedures with real world applications.**
4. **To understand how waste biomass can be converted to wealth.**
5. **To understand importance of recycling and its application in circular economy.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	$(2 \times 15) = 30$	100%
2	**E-learning**		
3	**Hybrid** • **Traditional classroom** • **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		30

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding;** *Upon completion of the course, students are able to:*			
1.1	***Demonstrate a comprehensive understanding of the principles and concepts of sustainable chemistry and green metrics such as atom economy and e-factors and the availability of alternate solvents and make informed choices based on Chemistry principles. (P)***	**K(1)**	***Lecture / Open discussion in class***	***Objective Questions***
1.2	***Describe and explain correctly the possible methods of reducing CO_2 emissions and analyze their respective merits and the principles for Green Chemistry in order to make a life cycle***	**K(2)**	***Lecture / Open discussion in class***	***Objective questions, Essay questions***

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	assessment for a chemical product including waste treatment. (P)			
2.0	**Skills;** *Upon completion of the course, students are able to:*			
2.1	***Calculate the atomic efficiency and E-factors of chemical reactions and processes and compare actual industrial chemical syntheses/processes and identify their strengths and weaknesses in a green chemistry perspective. (P)***	**S(1)**	***lecture / Open discussion in class***	***Essay questions, Solving problems***
2.2	***Make effective use of communication, and online technology about the course topics in order to improve their basic knowledge in writing (report / poster) with a good verbal and clear scientific language. (P)***	**S(5)**	***project-based learning***	***Research presentation rubric***
3.0	**Values, autonomy, and responsibility;** *Upon completion of the course, students are able to:*			
3.1	***Recognize the chemist's professional and ethical responsibilities. (P)***	**V(2)**	***Research activities***	***Ethic Rubric check***

C. Course Content

No	List of Topics	Contact Hours
1.	**Basic Concepts of Sustainable Chemistry; Sustainability assessment; Essentials of sustainable chemistry; Role of chemistry in sustainability.**	4
2.	**Definition of concepts and principles for green chemistry; predict the properties and environmental aspects before synthesis; Use of catalysts, to reduce time and energy demands, minimize waste; Design for energy efficiency.**	5
3.	**Green Solvents; Atom economy, metathesis; Ionic liquids, classification, synthesis & applications.**	4
4.	**Green Synthetic Methods.**	5
5.	**Value addition to Waste Biomass.**	4
6.	**Sustainable materials, Application of Renewable Raw Materials in organic synthesis, Biodegradable polymers , synthesis of biodegradable polymers.**	4
7.	**Recycling and circular economy; plastic recycling in circular economy. Sustainable packaging. Life Cycle Analysis (LCA)**	4
Total		$2 \times 15w = 30$

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	*Periodic Exams*	*During Semester*	*30%*
2.	*Assignments & Classroom Activities*	*During Semester*	*20%*
6.	*Final Exam*	*16-17*	*50%*
	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	**Introduction to Green Chemistry: Albert S. Matlack, 2nd edition, CRC Press, 2010.**
Supportive References	**1. New trends in green chemistry: V. K. Ahluwalia, M. Kidwai Anamaya Publisher, 2004.** **2. Green Solvents-Ionic Liquids: Paul T. Anastas (Series Editor), Peter Wasserscheid, Annegret Stark, Wiley-VCH, 2013.** **3. الكيمياء الخضراء، عماد صبري شاكر، الدار العربية للنشر والتوزيع، 2009.** **4. Sustainable chemistry: G. Reniers and C.A Brebbia, WIT Press, 2011.**
Electronic Materials	**Some course contents and materials are posted on Black board sites**
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	1 Lecture room(s) for groups of 50 students
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	none

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Likert-type Survey CES) Indirect
Effectiveness of Students' assessment	Instructor & Course coordinator	Class room evaluation (direct & indirect
Quality of learning resources	Program coordinator	Indirect
The extent to which CLOs have been achieved	Assessment committee	Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physical Sciences Department Council
REFERENCE NO.	Meeting (3)
DATE	12/03/2024 -02/09/1445