University of Kerala

Discipline	CHEMISTRY				
Course Code	**UK3VACCHE200**				
Course Title	**LABORATORY SAFETY**				
Type of Course	**VAC**				
Semester	3				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3
Pre-requisites	1. Basic science knowledge and interest in chemistry				
Course Summary	This course provides comprehensive training on laboratory safety protocols, chemical hazards, proper handling of chemicals and apparatus, safety equipment usage, emergency procedures, and laboratory waste management, with a focus on Indian regulations and challenges. Students will gain essential knowledge and skills to ensure safe and responsible practices in chemical laboratories, emphasizing compliance with legal frameworks and environmental protection.				

Detailed Syllabus:

Module	Unit	Content	Hrs
	LABORATORY SAFETY		**45**
I	**INTRODUCTION TO LAB SAFETY**		**6**
	1	Introduction, Eye Protection-Clothing- Gloves, Laboratory Protocol - Laboratory Visitors - Comportment in the Laboratory	3
	2	Housekeeping-Cleaning Glassware - Inhaling Harmful Chemicals – Distillations – Extraction – Refrigerators - Disposal - General Disposal Guidelines.	3
II	**CHEMICAL HAZARDS**		**6**
	3	Toxicity, Explosivity, Flammability, Corrosivity, Exposure Limits, Sources of Information, Material Safety Data Sheets (MSDSs), Understanding an MSDS, Labels, Reading MSDSs and Labels, Physical hazards, Environment hazards and symbols	3
	4	The Properties of Chemicals, Learning Chemistry from an MSDS, Classifying Hazardous Chemicals - Solvents and Their Hazards - Acids and Bases - A Few Examples of Toxic Materials - Organic Peroxides	3

		and Peroxide Formers, Physical hazards, Environment hazards and symbols	
III	**WORKING WITH CHEMICALS AND APPARATUS**		**9**
	5	Equipment Use - Laboratory Hoods, Precautions for Using Electrical Equipment, Centrifuges, Using Steam, Using High-Pressure Air, Ultraviolet Lamps.	4
	6	Controlling Temperature - Oil and Sand Baths, Cooling Baths and Cold Traps, Dry Ice Cooling Baths and Cold Traps, Cryogenic Liquid Cooling Baths and Cold Traps, Working with Reduced Pressure.	5
IV	**SAFETY EQUIPMENT, EMERGENCY PROCEDURES & LABORATORY WASTE MANAGEMENT**		**15**
	7	General Information, Fires - Fire Prevention, dealing with a Fire, Personal Injuries Involving Fires	3
	8	Chemicals on Skin, Clothing, and Eyes, Other Personal Injury Accidents, Spill Cleanup	4
	9	Introduction to waste management, Chemical waste disposal, glass disposal, emergency procedures, Response to incidents and accidents	3
	10	Indian regulations on chemical and hazardous waste management, Brief idea on Legal Framework on Chemical and Hazardous Waste in India, Issues and Challenges in Production, Storage and Transport of Chemicals in India:	5
V	**OPEN ENDED MODULE:**		**9**
	11	Seminar presentations, group discussions, debates, quizzes, case studies etc on the above modules - searching for safety equipments and identify potential hazards in the lab - case studies involving lab accidents or safety violations – Inspections in the lab for safety hazards - Creative and practical designs and innovative ideas for personal protection, hazard warnings, emergency response systems etc. **(Or any other related activities introduced by the teacher)**	

References

1. *Safety in Academic Chemistry Laboratories, volume 1, Accident prevention for college and university students*, 7th Edn (ISBN 0-8412-3863-4), American Chemical SocietyWashington, DC.
2. *Techniques of Safety Management* (ISBN: 978-18-8-558139-6), Dan Petersen, McGraw-Hill Book Co. Ltd., New York, N.Y. USA.
3. *Hazardous Chemical Data Book* (ISBN:081-551072-1), G. Weiss, Noyes Data Corporation, Park Ridge, New Jersey, N.Y. (USA).
4. *Environmental Health & Safety Management*, Nicholas & Madelyn, Jaico Publishing House, Mumbai.
5. *Hazardous waste management, Volume II, Characterisation and treatment process*, Sukalyan Sen Gupta.
6. *Solid and Hazardous waste management*, 2nd edition, M.N.Rao.
7. *Handbook on chemicals & hazardous waste management & handling in India*, MOEFCC.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Proficiency in implementing laboratory safety measures, including proper attire and eye protection, adherence to laboratory protocols, and maintaining a safe environment	U, An, Ap	PSO-2,3,4,5
CO-2	Identify physical and environmental hazards and symbols associated with various substances.	An, Ap	PSO-2,3,4,5
CO-3	Proficiency in the safe and effective use of laboratory equipment and temperature control methods	An, Ap	PSO-2,3,4,5
CO-4	Competence in fire safety protocols, including prevention measures, effective response to fires, and procedures for managing personal injuries caused by fires or chemical exposure	Ap, E	PSO-2,3,4,5
CO-5	Proficiency in waste management practices and effective response to incidents and accidents in laboratory settings	Ap, E	PSO-2,3,4,5
CO-6	Gain an understanding of Indian regulations governing chemical and hazardous waste management and legal framework, issues, and challenges related to the production, storage, and transport of chemicals.	U, An	PSO-2,3,4,5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: LABORATORY SAFETY

Credits: 3:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO-1	PO-1,2,3,6,8 PSO-2,3,4,5	U, An, Ap	C, P	L	-
2	CO-2	PO-1,2,6,8 PSO-2,3,4,5	An, Ap	C, P	L	-

3	CO-3	PO-1,2,3,6,8 PSO-2,3,4,5	An, Ap	C, P	L	-
4	CO-4	PO-1,2,3,6,8 PSO-2,3,4,5	Ap, E	P, M	L	-
5	CO-5	PO-1,2,3,6,8 PSO-2,3,4,5	Ap, E	P, M	L	-
6	CO-6	PO-1,2,3,4,6,8 PSO-2,3,4,5	U, An	C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO2**
CO 1	-	1	3	3	2	1	2	2	-	-	2	-	2
CO 2	-	1	3	3	2	2	2	1	-	-	2	-	2
CO 3	-	1	3	3	2	1	2	2	-	-	3	-	2
CO 4	-	1	3	3	2	1	2	1	-	-	2	-	2
CO 5	-	1	3	3	2	2	1	1	-	-	3	-	2
CO 6	-	1	2	3	1	1	1	2	2	-	2	-	2

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓		✓	✓
CO 6	✓		✓	