



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	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	9
	3	Types of Chemical Hazards – Physical, health and environmental. Exposure Limits – TLV, STEL and IDLH, Sources of Information, Material Safety Data Sheets (MSDSs), Understanding an MSDS, CIS understanding HAZCHEM Code, class, - Basic ideas of emergency response guides.	4
	4	Learning Chemistry from an MSDS (eg: Alcohols, Hydrocarbons, CCl ₄ , CHCl ₃ & THF), Solvents and Their Hazards - Acids and Bases - A Few Examples of Toxic Materials – Chlorine, H ₂ SO ₄ , phenol & carbides -	5



		Organic Peroxides and Peroxide Formers, Handling of radioactive substances, Physical hazards, Environment hazards and symbols	
III	WORKING WITH CHEMICALS AND APPARATUS		6
	5	Equipment Use - Laboratory Hoods, Precautions for Using Electrical Equipment, Centrifuges, Using Steam, Using High-Pressure Air, Ultraviolet Lamps.	3
	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.	3
IV	SAFETY EQUIPMENT, EMERGENCY PROCEDURES & LABORATORY WASTE MANAGEMENT		15
	7	General Information, Fires – Types of Fires & Extinguishing Media, Fire Prevention, dealing with a Fire, Personal Injuries Involving Fires & their first aid	3
	8	Chemicals on Skin, Clothing, and Eyes, Other Personal Injury Accidents & first aids, 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, General provision on Storage, Handling & Transportation of chemicals.	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 Society Washington, 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	Safely and effectively implement laboratory protocols, including the use of personal protective equipment, proper handling of chemicals and glassware, adherence to housekeeping standards, and appropriate disposal methods to ensure a safe and compliant laboratory environment.	An	PSO-2,3,4,5
CO-2	Identify and classify hazardous chemicals based on their toxicity, explosivity, flammability, corrosivity, and environmental impact, accurately interpret Material Safety Data Sheets (MSDS) and chemical labels, and apply safety measures to manage physical and environmental hazards effectively.	An	PSO-2,3,4,5
CO-3	Safely operate and maintain laboratory equipment—including hoods, electrical devices, centrifuges, steam systems, high-pressure air, and ultraviolet lamps—and effectively apply various temperature control techniques.	E	PSO-2,3,4,5
CO-4	Understand and apply principles of fire prevention and emergency response, manage chemical and personal injury incidents safely, execute proper waste disposal methods, and comprehend the regulatory and legal framework governing chemical and hazardous waste management in India, including challenges in chemical production, storage, and transport.	C	PSO-2,3,4,5
CO-5	Develop the ability to identify laboratory hazards, understand safety equipment, and design effective personal protection and emergency response solutions to ensure a safe working environment.	C	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	An	C, P	L	-
2	CO-2	PO-1,2,6,8 PSO-2,3,4,5	An	C, P	L	-
3	CO-3	PO-1,2,3,6,8 PSO-2,3,4,5	E	C, P	L	-
4	CO-4	PO-1,2,3,6,8 PSO-2,3,4,5	C	P, M	L	-
5	CO-5	PO-1,2,3,6,8 PSO-2,3,4,5	C	P, M	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

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	✓		✓	✓

