



University of Kerala

Discipline	PHYSICS				
Course Code	UK3VACPHY201				
Course Title	INTRODUCTION TO LABORATORY SAFETY MEASUREMENTS				
Type of Course	VAC				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 Hrs	-	-	3 Hrs
Pre-requisites					
Course Summary	<p>This course provides a comprehensive overview of laboratory safety, covering general safety principles, operational rules, and safety equipment. It also includes an introduction to electrical and chemical safety measures, focusing on inspection, testing, protective clothing, and safe handling of hazardous substances. Additionally, the course explores radiation effects, monitoring, and safety protocols in nuclear physics labs, as well as gas safety norms, including the characteristics, properties, and standard operating procedures for various gases used in industrial and laboratory environments.</p>				

BOOKS FOR REFERENCE:

1. Safety measurements for Indian Laboratories, Ajay Kumar Gupta & Prithanshu, ISBN: 1312254084, Lulu. (Chapter)
2. Electrical Safety Hand book, John Cadick, Mary-Capelli-Schellpfeffer, Dennis, Neitzal (3rd Edition), McGraw-Hill (Chapter 2)
3. Hand book of Chemicals and Safety, TSS, Dikshith, ISBN No: 13-978-1-4398-2 (E-book), CRC Press, Taylor & Francis. (Chapter 2 & Chapter 3)

4. Nuclear Physics, D. C. Tayal, Himalaya Publishing (Chapter 16)
5. Techniques for Nuclear and Particle Physics experiments, W. R. Leo (Chapter 3)
6. Hazardous Gases: Risk Assessment on the environment and Human health, Jospel singh, R. D. Koushik and Malavika Chawala, ISBN: 978-0323898577, Academic Press

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I	Introduction		9	
	1	Introduction to general lab safety	4	1
	2	Lab operational rules, safety equipments	5	1
II	Electrical safety measures (Book 2)		9	
	3	Introduction to electrical safety measures	2	1
	4	General Inspection and Testing, Safety clothing, Insulated tools	2	1
	5	Arc, Electrical flash and thermal protection.	2	1
	6	Safety tags, locks, barriers. Safety grounding, circuit breaker, safety measuring instruments	3	1, 2
III	Chemical safety measures		9	
	7	Introduction to use of chemical substances.	1	1
	8	Classification/Categorization of chemicals causing - irritation effect, allergens, asphyxiants, acids, alkalies, carcinogens	3	2, 3
	9	Cryogenic gases, EDC, Neurotoxins.	2	2, 3
	10	Safe disposal of Chemical substances, Regulatory agencies and their role.	2	1, 3
	11	Chemical substances, exposure, occupation and hazards	1	1, 3
IV	Radiation effects (Book 4: Chapters 3 and 16)		9	
	12	Radiation monitoring and dose meter, Physical effects of radiation. Chemical effects of radiation	3	4
	13	Absorbed dose, Relative biological effectiveness, dose equivalent, Biological effects, Maximum	3	4
	14	Permissible Dose (MPD), Shielding, Radiation safety in nuclear physics lab (Book 5, Chapter 3)	3	4

V*	Gas safety norms		9	
	15	Different gases used in industry and lab,	3	5
	16	characteristics and properties of gases - O ₂ , O ₃ , N ₂ , H ₂ , Co, methylene, ethylene, Petroleum gases, CNG	4	5
	17	Standard operating procedures for gases	2	5

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Comprehend fundamental laboratory safety guidelines, operational rules, and the appropriate use of safety equipment, fostering a safe lab environment and minimizing the likelihood of accidents or injuries during experiments.	U	PSO-1,3
CO-2	Understand and remember essential electrical safety measures, including inspection, safety clothing, insulated tools, arc protection, and safety devices like tags, locks, grounding, and circuit breakers, ensuring safe practices in electrical work environments.	R, U	PSO-1,3
CO-3	Apply knowledge of chemical substance classification, disposal methods, regulatory agencies, and occupational hazards to effectively manage and mitigate risks in practical scenarios.	Ap	PSO-1,3
CO-4	Demonstrate proficiency in radiation monitoring and the use of dose meters, comprehend the physical and chemical effects of radiation, including absorbed dose and relative biological effectiveness, understand concepts such as dose equivalent and maximum permissible dose (MPD), apply principles of shielding for radiation safety in nuclear physics laboratories.	U	PSO-1,3
CO-5	Identify various gases utilized in industry and laboratory settings, discern their unique characteristics and properties, including O ₂ , O ₃ , N ₂ , H ₂ , Co, methylene, ethylene, petroleum gases, and CNG, and develop standard operating procedures for their safe handling and usage.	U	PSO-1,3

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

**Name of the Course: INTRODUCTION TO LABORATORY SAFETY
MEASUREMENTS**

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

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Comprehend fundamental laboratory safety guidelines, operational rules, and the appropriate use of safety equipment, fostering a safe lab environment and minimizing the likelihood of accidents or injuries during experiments.	PO1,3,4, 5,6,8/ PSO-1,3	U	U	L	-
CO-2	Understand and remember essential electrical safety measures, including inspection, safety clothing, insulated tools, arc protection, and safety devices like tags, locks, grounding, and circuit breakers, ensuring safe practices in electrical work environments.	PO1,3,4, 5,6,8/ PSO-1,3	R, U	R, U	L	-
CO-3	Apply knowledge of chemical substance classification, disposal methods, regulatory agencies, and occupational hazards to effectively manage and mitigate risks in practical scenarios.	PO1,3,4, 5,6,8/ PSO-1,3	Ap	Ap	L	-

CO-4	Demonstrate proficiency in radiation monitoring and the use of dose meters, comprehend the physical and chemical effects of radiation, including absorbed dose and relative biological effectiveness, understand concepts such as dose equivalent and maximum permissible dose (MPD), apply principles of shielding for radiation safety in nuclear physics laboratories.	PO1,3,4, 5,6,8/ PSO-1,3	U	U	L	-
CO-5	Identify various gases utilized in industry and laboratory settings, discern their unique characteristics and properties, including O ₂ , O ₃ , N ₂ , H ₂ , CO, methylene, ethylene, petroleum gases, and CNG, and develop standard operating procedures for their safe handling and usage.	PO1,3,4, 5,6,8/ PSO-1,3	U	U	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	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	2	-	2	-	-	-	-	2	-	3	2	2	2	-	2
CO-2	2	-	3	-	-	-	-	2	-	2	2	2	2	-	2
CO-3	3	-	2	-	-	-	-	3	-	3	2	2	2	-	2
CO-4	2	-	2	-	-	-	-	3	-	2	2	2	2	-	3
CO-5	2	-	2	-	-	-	-	2	-	3	2	2	2	-	2

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	-	✓
CO-2	✓	-	-	✓
CO-3	✓	-	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	-	✓