

Vocational Programme in Chemistry Discipline

Title:- Systematic Chemistry Laboratory Techniques (SCLT)

Faculty: Science

The present vocational programme is proposed for those students who are aiming their career as laboratory technicians/assisting staff in chemistry laboratory, distilleries, pharma sector and other small-scale industries. There are so many scopes for employability after this programme as lab staff/assistant in school or college laboratories. The course will also give strong technical hands to the students in the direction of skill development and for their own startups as medium or small scale industries. At present, the university does not have any programme for learner students to impart the knowledge for chemistry laboratory techniques through the regular curriculum. This vocational programme has been designed to produce the fully trained laboratory supporting staff in appropriate procedures for organizing and maintaining school/college (degree, agricultural, engineering, pharmacy etc.) chemistry laboratories and various other related industrial sectors.

- **OBJECTIVES**

The course covers the broad objectives as to:

1. introduce the learners about the basic facilities available in school, college and industrial level chemistry laboratories;
2. impart knowledge of the basics and structure of organization and management of laboratories;
3. train the learners in the operation and maintenance of chemicals & common apparatus used in laboratories;
4. familiarize them to develop skills in common laboratory techniques;
5. trained them in the procedures of procurement and storage of laboratory equipment, apparatus, glass wares and chemicals;
6. enable them to follow appropriate disposal procedures and safety measures required for chemistry laboratories;
7. produce well trained Staff /Technicians /Assistants to work in chemistry labs, especially at the Schools, Colleges, Pharma industries or other small scale industries more efficiently and productively.

• **SALIENT FEATURES OF THE PROGRAMME**

The syllabus of programme is specially designed to produce well trained laboratory staff. The programme has very selective approach to achieve the theoretical as well practical knowledge. The curriculum designed as learners will be able to have:

- knowledge of all commonly used chemicals, glasswares, apparatus, minor equipment etc.
- familiarity to cleaning and maintenance of glassware, equipment, apparatus and laboratory,
- understanding of theoretical aspects and working principles of chemistry labwares,
- preparation of standards solutions, buffer solutions, indicators, common laboratory reagents,
- knowledge to perform the some basic experiments.
- knowledge of all safety measures in the chemistry laboratory, proper disposal of chemicals, chemical wastes and other waste materials,
- awareness about the handling of corrosive chemicals, lab accidents, fire extinguishers and other safety means,
- knowledge of computer for proper organization and management of chemistry laboratories, minor electronic equipment, maintain lab record, inventory etc.

COURSE STRUCTURE*:

Programme : Vocational	Credits : 3
Total marks : 100	Min. Passing Marks : 35%
Discipline : Chemistry	Course Code : SCLT
Eligibility : Pass in (10+2)/Intermediate with Chemistry subjects	
Duration of programme : Two semesters	
Total lectures per week (L-P-T) = 1-2-1	
Examination pattern – as per university ordinance	

L- Lectures (1credit), P- Practical (1 credit), T- Tutorials (1credit)

*may vary as per university ordinance/guidelines come in force.

SYLLABUS

SEMESTER -1

Unit	Topic/s
I (Theory)	<p>Introduction of Chemistry Lab (05 Hours) General introduction of chemistry laboratory, common instruction for safe working in chemical laboratories, Lab design, Storage, ventilation, lighting, fume, cupboard, arrangement of store, Safety provisions, Organization of practical work, Maintenance of laboratory, equipment/ apparatus Cleaning of laboratories and preparation room.</p> <p>Introduction of Lab Apparatus (05 Hours) <i>Glass apparatus</i> - Beaker, Test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser Liebig flask, watch glass etc. measuring conical or condenser, petridish, desiccator. <i>Volumetric Apparatus</i> - Measuring cylinder, burette, pipette, Volumetric flask, analytical balance, single-pan electronic balance/ electrical analytical balance etc. <i>Miscellaneous apparatus</i>- Buchner funnel, Bunsen burner, burette stand, retort clamp, china dish/evaporating basin, wire gauze, cork borers, filter pumps, crucible, mohr clip, pipe clay triangle, pestle and mortar, sprit lamp, spatulas, thermometer, pH meter/pH paper etc. and laboratory centrifuge. <i>Apparatus for heating</i>: Bunsen burner, water bath, oil bath hot plate, sand bath, hot air oven, heating mantle etc. <i>Handling and storage of glass apparatus</i> <i>Kipp's apparatus</i></p> <p>Solution Preparation (05 Hours) Water as a solvent, types of water, solutions, components of a solution, types of solution, solubility, concentration of solutions: percentage, molarity, normality, molality (in ppm) calculation of masses and volumes for preparation of solutions solids, liquids.</p>
II (Practical)	<ol style="list-style-type: none"> 1. Handling of common laboratory equipment 2. Cork boring experiment 3. Calibration of volumetric glassware 4. Weighing of chemicals using analytical balance 5. Preparation of solutions, indicators and reagents. 6. Preparation of buffer solutions and determination of their pH Values. 7. Preparation of some organic compound and determination of their boiling point and melting point.
III (Tutorials)	<p><i>Activity 1</i>: Cleaning of laboratories and preparation room. <i>Activity 2</i>: Classification of apparatus in store. <i>Activity 3</i>: Cleaning of glassware. <i>Activity 4</i>: Organization of practical work. <i>Activity 5</i>: A brief report on Safety provisions in laboratories.</p>

SEMESTER -2

Unit	Topic/s
I (Theory)	<p>Common Laboratory Techniques (05 Hrs.) <i>Refluxing:</i> Apparatus with interchangeable ground glass joints (Quick fit), <i>Filtration:</i> Techniques and filter media, filter paper, simple filtration, <i>Recrystallization:</i> Choice of solvent and precautions with flammable solvents, <i>Distillation:</i> recovery of solvents through partial distillation, distillation under reduced pressure, and <i>Determination of Boiling Point</i></p> <p>Chemistry Laboratory Safety (03 Hours) <i>Fire Hazards:</i> Causes of fires, classification of fires, fire prevention protocols and measures, fire alarms, fire escapes, fire Extinguishers and their uses. <i>Chemical Hazards:</i> Classification and handling of hazardous chemicals, storage of chemicals, transfer from large containers <i>Gas Hazards:</i> usage of LPG and CNG safer in the laboratory, detection and handling of Gas Leakage, health hazards of gases</p> <p>Use of Computer in Laboratory (03 Hours) Hardware in computer, CPU, I/O devices, data input, data processing, data output, application MS office software and Internet.</p> <p>Stock and Inventory Control (02 Hours) Arranging stock, locating and referencing, shelf arrangement of stock, order books, inventory.</p> <p>Files and Records (02 Hours) <i>Filing Systems-</i> Classification of files, filing methods, filing system for equipments and chemicals, filing of printed and written material, preparation of lab manuals. <i>Records system :</i> Stock records, recording stock (used and misused), record of use of listed poisons, record of use of alcohol, record of breakages, information about equipment serial numbers, record maintenance, miscellaneous records.</p>
II (Practical)	<ol style="list-style-type: none"> 1. Preparation of hydrogen sulphide (H₂S) gas using Kipp's apparatus. 2. Simple acid-base titration. 3. Preparation of distilled/deionized water. 4. Purification of organic compounds by recrystallization. 5. Preparation of inorganic double salts. 6. Experiments based on chromatography
III (Tutorials)	<p><i>Activity 1:</i> Classification of chemicals in laboratory/store. <i>Activity 2:</i> Classification hazardous chemicals based on the information given on the labels. <i>Activity 3:</i> Preparation of comparative chart. <i>Activity 4:</i> To learn the use of a carbon dioxide fire extinguisher. <i>Activity 5:</i> Preparation of stock register on MS-Excel.</p>

Bibliography:

1. Vogels Qualitative Inorganic Analysis, A. I. Vogel, *Prentice Hall*.
2. Vogels textbook of chemical quantitative analysis, *Longman Scientific*
3. The golden book of chemistry experiments, R. Brent, *Golden press, NY*
4. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, *Universities Press*.
5. Lab Manual of Organic Chemistry, R. K. Bansal, *New Age Pub*.
6. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co
7. Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, *S. Chand*
8. Advanced practical chemistry, J . Singh etal. *Pragati Prakashan*
9. Computer fundamental , B Ram, *New Age Pub*.
10. <https://www.youtube.com/watch?v=dLUdhFlxZfo>
11. <https://chemicalsafety.com/chemical-inventory-management-software/>
12. <https://www.youtube.com/watch?v=D7rnlaR8Arc>