

Laboratory Skills & Techniques I

This laboratory-based module provides participants with the analytical and technical skills critical for carrying out different measurements in the chemical laboratory. These skills will be acquired through experiments on weighing, gravimetric and volumetric analysis, where related concepts such as atoms, molecules and stoichiometry, solutions, concentrations, acids, bases and salts will be taught. The module also include measurement of pressure, temperature and pH that are supported by the relevant theories in chemical equilibria, chemical energetics and reaction kinetics.

Laboratory Skills & Techniques II

This module aims to develop in participants the essential skills of observation and deduction necessary for working in the laboratory. These skills will be fostered when participants conduct experiments on qualitative analyses of inorganic and organic compounds. Practical sessions will be imbued with theories in atomic structure, chemical bonding, chemical periodicity, alkaline earth metals, halogens, transition elements, solubility product, as well as functional group reactions and nomenclature in organic chemistry. Participants will be able to build upon the skills and knowledge acquired in this module when they progress to subsequent modules.

Chemical & Biosafety

This module aims to provide participants with knowledge on important topics such as safety management of a chemical testing; safety planning; risk assessment; handling of hazards and chemical waste; storage and disposal of hazards; accident reporting, etc. Concepts of biorisk management and biosecurity are also covered. Laboratory design, practices and safety equipment of the four biosafety levels, routes of transmission and decontamination are taught. In addition, participants have to examine the implications of local and international regulations to laboratory operations such as Workplace Safety and Health Act and the Biological Agents and Toxin Act.

Synthesis and Separation Techniques

The aims of this module are to help participants acquire the skills associated with the syntheses of organic and inorganic compounds, the purification of solids and liquids (recrystallisation, filtration, solvent washing and distillation), as well as the identification of purified compounds (melting point determination and thin layer chromatography). Complementing the practical activities in this module will be essential theories such as chemical bonding, the Valence Shell Electron Pair Repulsion model, polarity, intermolecular forces, solubility equilibria and states of matter. The skills and knowledge attained by participants in this module will serve as a foundation for the acquisition of higher skills and knowledge in subsequent modules.

Spectroscopy

This module aims to train participants to be competent in applying the relevant theoretical knowledge and skills behind spectroscopy in chemistry to analyse contents of compounds through different spectroscopic techniques such as UV/Vis/IR/AAS/AES spectroscopy. Sampling techniques, operating principles, calibration and optimisation processes of each spectroscopic concept will be imbued during the practical session. Moreover, it shall prepare participants well with the ability to take on challenges independently in trouble-shooting and it encourages innovation where they can work effectively as a team in a laboratory. Participants will be able to apply skills and knowledge acquired in this module when they progress to subsequent modules.

Chromatography

This module aims to train participants to be competent in applying the theoretical knowledge learnt in separation science as well as demonstrating the mastery of skills in operating chromatography instrumentation by performing compound qualitative and quantitative analyses using various forms of chromatographic techniques such as GC, LC and IE. Complementing the hands-on activities in this module shall be furnished with the learning of operating principles, calibration and optimisation process of each technique. Participants will be able to apply skills and knowledge acquired in this module when they progress to subsequent modules.

Applications in Laboratory Analysis

This laboratory-based module imparts participants with the knowledge and skills on the applications of chromatography and spectroscopy techniques in laboratory analyses. Relevant case studies from different sub-sectors of the chemical industry will be given to the participants where skills acquired on instrumental analyses will be reinforced. The module also covers the design of a project scope where the participants will execute during their On-Job-Training (OJT). Examples of a project scope will range from lab improvement to the optimisation of a lab procedure or work flow.

Applied Statistics & Quality Assurance⁺

This module aims to provide an understanding of important concepts of ISO 9000, ISO 14000, quality assurance and the use of statistics in quality control in control charts and experimental design in the chemical manufacturing, life science and service sectors.

Good Laboratory Practices & Management⁺

On completion of this module, participants will be equipped good laboratory practice and quality management skills to work effectively and manage daily laboratory operations. Participants will also develop capability in problem solving of economic and technical aspects of laboratory management so as to better prepare for support of laboratory activities.

On-Job-Training

This module aims to equip participants with the competencies, skills and professionalism that are required of a laboratory technician. Participants will apply the knowledge and laboratory techniques that they have acquired to a working environment in the chemical industry. Participants are also required to complete a project which they have proposed in their working environment.

Organic Chemistry – Reaction Mechanisms

The module aims to give students the fundamental concepts of organic chemistry and its reaction mechanisms. Laboratory sessions on organic syntheses and kinetic measurements will reinforce the concepts taught in the lectures. This will provide participants with the capability to understand and rationalise the products obtained in terms of reaction pathways.

Basic Biochemistry

The module aims to provide participants with an understanding of the structure of water and biomolecules like proteins, carbohydrates and lipids. The types and functions of enzymes and energy and their roles in cells will be covered.

Forensic Chemistry

The module provides students with laboratory skills and theoretical knowledge of forensic chemistry. It provides participants with the ability to develop problem-solving skills and encourages them to think and learn independently.

Petrochemicals & its Applications

To provide students with the detailed theoretical knowledge of the various processes and the chemistry involved to refine petroleum to basic chemical building blocks, followed by their conversion to some useful common and specialty chemicals. The importance of petrochemicals to the Singapore's economy is discussed. Students will acquire the essential skills to determine the physical and chemical properties of petroleum products and petrochemicals.

Materials for the Modern World

This module aims to provide broad-based and fundamental knowledge in the understanding of conventional and advanced materials, in terms of their structures, properties, testing methods, processing methods and applications, for the selection of the right materials to suit different needs.

Environmental & Water Technology

This module aims to provide students with the underlying principles and key concepts of environmental and water technology and how these can be applied to the resolution of contemporary global issues such as climate change, environmental degradation, transboundary pollution, species extinction, soil remediation, etc. It enhances a growing environmental awareness towards waste minimisation, environmental impact assessment, industrial health and safety, quality and purification of water. Practical classes will impart students with hands-on laboratory skills relating to environmental and water analyses while case studies assignments will develop students' awareness and global perspective of the current developments in environmental and water technology.