Module Synopses

Modular Certificate 1 in Core Chemistry I, Chemical Processes & Safety

Module 1 – Chemistry I

Upon completion of this module, students will develop an in-depth understanding of the electronic structure of atoms and its basis for the study of chemical bonding. Students will learn to apply the VSEPR model to visualise three dimensional structure of molecules and determine the possible types of interactions to explain the physical and chemical properties of matter. They will also learn the structure and bonding of matter and be able to predict trends in the properties of matter and its reaction. This will enable students to apply the fundamental ideas of conservations of matter and energy in stoichiometry and thermochemistry. The module also aims to equip students with the analytical and observation skills and techniques critical for working in a chemical laboratory by exposing them to a range of experimental techniques in the areas of titration, thermochemistry and qualitative inorganic analysis.

Module 2 – Introduction to Chemical Processes

This module provides students with basic understanding of chemical engineering principles and applications of engineering measurements. Types of processes (unit operations) and equipment used in the chemical industry will be covered too. Students will also learn to interpret engineering drawings.

Module 3 – Chemical Safety and Biosafety

This module aims to provide students with knowledge on important topics such as risk groups; risk assessment; handling of Biohazardous materials and chemical waste; storage and disposal of biohazards. Laboratory design, safe practices and containment equipment of the four biosafety levels, routes of transmission and decontamination are taught. In addition, students have to examine the implications of local regulations to laboratory operations such as the Workplace Safety and Health Act (WSHA) and the Biological Agents and Toxin Act (BATA).

Modular Certificate 2 in Core Chemistry II, Instrumentation & Microbiology

Module 1 – Chemistry II

Upon completion of this module, students will develop a basic understanding that changes in matter involved the study of its feasibility due to kinetics and thermodynamics consideration and extent of change. The qualitative and quantitative aspects of chemical kinetics are introduced to students and this will form the basis for the study of chemical equilibrium, including chemical equilibria in aqueous media involving acids and bases. Topics in organic chemistry will introduce students to basic concepts on how simple molecules can be constructed and applied to organic reaction transformations and functional group interconversion. This provides students the opportunity to apply their knowledge on structure and bonding to understand the structure and reactivity of organic molecules. The module also aims to equip students with the analytical and observation skills critical for working in a chemical laboratory by exposing them to a range of experimental skills and techniques in the areas of reaction kinetics, simple organic synthesis and purification and qualitative organic analysis.

Module 2 – Instrumental Analysis

This module aims to provide students with practical laboratory skills and theoretical knowledge to perform chemical analysis using analytical instruments such as gas and liquid chromatograph~~,~~ ultra-violet visible, infra-red spectrophotometer, etc. It provides students with a capability for problem

solving, independent thinking and innovation so that they can work effectively in research teams and/or in the industry on life science or chemical analysis.

Module 3 – Microbiology
This module aims to provide students with basic understanding of microbiology. The methodology used in the study of microorganisms will be taught and reinforced during the practicals for students to acquire bench skills in aseptic techniques. In addition, students will be given an overview of the importance of and use of microbes in the food industry, in treatment of environmental oil spills and bioremediation, geochemical life cycles and human diseases.

Modular Certificate 3 in Laboratory Management, Environment & Statistics

Module 1 – Environmental Sustainability
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 to students hands-on laboratory skills and experience relating environmental and water analysis while case studies assignment will develop students' awareness and global perspective of the current developments in environmental and water technology.

Module 2 – Good Laboratory Practice and Management
On completion of this module, individuals will be competent in terms of knowledge and skills in managing an accredited laboratory. He or she will also be trained to maintain the rigour of a quality documentation and technical competency in a testing laboratory. Being conversant with international standard guidelines on good laboratory practices and management, they could work efficiently and effectively in a chemical/biological accredited laboratory.

Module 3 – Applied Statistics and 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.

Modular Certificate 4 in Applied Chemistry & Data Analytics

Module 1 – Chemistry III
The module aims to provide students with the fundamentals of organic synthesis and reaction mechanisms. Topics include stereochemistry, chemical kinetics, substitution, addition and elimination reactions.

Module 2 – Data Analytics for Industrial Application
This module aims to equip participants with the knowledge on a range of data analysis tools and also the skills to apply these tools on industrial data. Participants will learn to develop efficient models for predictive data analysis and to apply the trained models on offline data and on streaming data to generate automated alerts.

Module 3 – Biochemistry
The module aims to provide students 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.

Modular Certificate 5 in Life Science

Module 1 – Molecular Genetics
This module aims to provide students with the theoretical knowledge and practical skills in molecular biology and genetic analysis. It also supports the overall course aims of developing problem-solving skills in these areas of knowledge by encouraging students to analyse and solve problems in genetic and molecular biology independently. Students will learn the fundamentals of genetics, function of genes and the concepts and applications of recombinant DNA technology and the tools used in molecular biology.

Module 2 – General Anatomy & Physiology
The subject is designed to introduce the structure and function of the various systems and organs of the human body. The students are given an overview of the basic concepts in human physiology in relation to the gross and microscopic anatomical structures of organs and how they function.

Module 3 – Forensic Science
This module aims to provide students with knowledge on the basic principles and skills for forensic investigations in the chemical and life sciences. The topics covered include chain of custody and crime scene investigation, arson and explosives, DNA and protein analysis of samples from crime scenes and paternity testing, toxic inorganic elements and organic compounds, drugs, food forensic as well as toxicology. Real-life case studies will be introduced into each topic and the students will apply their knowledge to these studies. In addition, the important mind-sets essential by all analysts will be introduced and their implications on the law and judgement in court. Students will also acquire the practical skills to analyse and characterise important chemicals encountered in forensic laboratories.

Modular Certificate 6 in Industrial Chemistry

Module 1 – Chemical Process Plant Equipment
This module also provides the learners with knowledge on the different types of chemical process plant equipment, their uses, functions of components, operating principles and commissioning procedures.

Module 2 – Petrochemicals and its Applications
This module aims to provide students with laboratory skills and the theoretical knowledge of petrochemicals and its applications. Detailed knowledge of the various processes to convert petrochemicals to basic building blocks followed by their conversion to useful common and specialty chemicals, as well as their importance to Singapore's economy will be taught. In addition, the role of the specialty chemicals derived from petrochemicals will be covered. Students will acquire the essential skills to determine the physical and chemical properties of petroleum products and petrochemicals.

Module 3 – Chemical Process Automation and Robotics
This module covers the concepts on how industrial processes can be monitored and controlled. By drawing students' underpinning knowledge in chemical engineering principles, they will solve problems involving process characteristics, process instruments and measurement, and process operation, control and optimisation. Students will also learn basic robotics and its applications in chemical engineering.