

# Diploma in Chemical Analysis and Instrumentation Techniques DCAIT - SC210 (Under Review)

## 1. Aims and Objectives

The diploma in Chemical Analysis and Instrumentation Techniques is designed to meet the requirement of Chemical Laboratory Technicians in the areas related to analytical, physical and biochemical fields. The program's training deals with fundamental chemical principles, basic laboratory techniques and modern chemical instrumentation which will enable the trainee to adapt to exciting technological advances in chemistry. In addition to the more scientific discipline this course will also provide the students basic knowledge in laboratory Management and Quality control and Quality Assurance.

## 2. General Entry Requirements for Admission to the University

As per General Entry Requirements for admission to the University for Diploma.

## 3. Programme Requirements

Credit at GCE 'O' level including Mathematics and Chemistry

Pass at GCE 'A' Level in at least 2 Science subjects (Mathematics, Chemistry, Physics, Biology, Food and Nutrition)

## 4. Programme Duration

	Normal	Maximum
Diploma (Part-time)	3 years	5 years

## 5. Credit System

15 Hours Lectures and/or Tutorials - 1 Credit

15 Hours of Practical Work – 0.5 Credit

## 6. Credits Required for Award : 60

Breakdown as follows:

Core Taught Modules	Credits from	
	Project	GEMs
50	4	6

## 7. Assessment

Each module will carry 100 marks (i.e. expressed as %) and will be assessed as follows (unless otherwise specified).

Assessment will be based on a written examination of 2h for 3 credit modules and 3h for 4 credit modules and on continuous assessment carrying 30% of total marks. Continuous assessment may be based on laboratory work, and/or assignments and should include at least 2 class tests/ assignments.

An overall total of 40% for combined continuous assessment and written examination components would be required to pass the module, without minimum thresholds within the individual continuous assessment.

**CHEM 1003Y(1)** and **CHEM 2005Y(3)** will be assessed solely by continuous assessment (Passmark: 40%).

## 8. Important note

The rules are stipulated in this Programme structure and Outline syllabus will replace all other rules and regulations.

## 9. List of modules

Code	Module name	Hrs L + P	Credits
<b>Year I</b>			
CHEM 1001Y(1)	Chemistry I	60 + 0	4
CHEM 1002Y(1)	Analytical Techniques I	45 + 0	3
CHEM 1003Y(1)	Basic Laboratory Techniques and Lab safety	0 + 90	3
PHYS 1010Y(1)	Electronic instrumentation and measurement	37.5 + 15	3
CHEM 1004Y(1)	Fundamental Mathematics	45 + 0	3
CSE1010e	Introduction to IT	O.E.	3
<b>Year II</b>			
CHEM 2001Y(3)	Chemistry II	60 + 0	4
CHEM 2002Y(3)	Analytical Techniques II	45 + 0	3
CHEM 2003Y(3)	Food and Pharmaceutical Chemistry	37.5 + 15	3
CHEM 2004Y(3)	Chemical safety and toxicology	45 + 0	3
BIOS 2088 Y(3)	Microbiology	37.5 + 15	3
CHEM 2005Y(3)	Practical Chemistry	0 + 90	3
<b>Year III</b>			
CHEM 3001Y(5)	Project		4
CHEM 3002Y(5)	Analytical Techniques III	45 + 0	3
CHEM 3003Y(5)	Environmental Science and Waste Management	45 + 0	3
CHEM 3004Y(5)	Quality Control and Quality Management	45 + 0	3
CHEM 3005Y(5)	Forensic Investigation and analysis	45 + 0	3

## 10. Outline Syllabus

### CHEM 1001Y (1) - CHEMISTRY I

This module will introduce the basics of organic, inorganic and physical chemistry:

Atomic structure and electronic configuration of atoms; chemical bonding in molecules; semiconductors and crystal structure of ionic solids; principles underlying the periodic table of elements; shapes of molecules; chemistry of acids and bases; states of matter, general gas equations, simple kinetics; chemical energetics, electrochemistry, phase-equilibria: one component phase diagrams, Raoult's law, surface tension, viscosity; solutions, solubility, colligative properties, colloids; classification of organic compounds, nomenclature of organic molecules, structure and bonding; chemistry of aliphatic compounds (alkanes, alkenes, alkyl halides, alkynes, alcohols, ethers, aldehydes, ketones, organic acids).

### CHEM 1002Y(1) - ANALYTICAL TECHNIQUES I

Units & concentrations; errors and significant figures; chemical equilibrium; solubility product; titrations, gravimetric and combustion analyses, systematic treatment of equilibrium, acid / base reactions; acid / base titrations; redox reactions and titration; electrodes.

**CHEM 1003Y(1) - BASIC LABORATORY TECHNIQUES AND LAB SAFETY**

A basic course in laboratory safety with emphasis on safe handling and storage of chemicals; care and use of safety equipment; experiments from the field of organic, analytical, inorganic and physical chemistry will be carried out with emphasis on precautionary measures to be taken when carrying out these experiments.

**PHYS 1010Y(1) - ELECTRONIC INSTRUMENTATION AND MEASUREMENT**

Basic electrical components; introduction to DC and AC circuits (analysis and measurement); sensors; amplifiers; noise in electrical circuits; analog to digital converters; data acquisition systems; measurement uncertainty; data fitting using the least squares method; calorimetry.

**CHEM 1004Y(1) - FUNDAMENTAL MATHEMATICS**

Solving linear systems of equation; inequalities; sigma and pi notation; functions; exponential; logarithmic; inverse functions; essential co-ordinate geometry; Maclaurin and Taylor Series, integration of basic functions; integration by substitution; integration by parts; finite integration; numerical integration, functions of several variables and partial differentiation, differential equations: first and second order differential equations; boundary conditions; matrix notation; elementary matrix operations, properties, determinants, invertible matrices; eigen values and eigenvector; Preliminary data analysis, probability, permutations and combinations; introduction to statistics, discrete and continuous probability distributions, point and interval estimation, hypothesis testing, regression analysis, Data analysis, excel and spreadsheet.

**CSE 1010e (1) - INTRODUCTION TO INFORMATION TECHNOLOGY**

IT and computers; stepping in the computer; input and output devices, secondary storage, programming, systems software, applications software, systems development, computer networks, the Internet, computer security, software utilities, issues and trends in IT.

**CHEM 2001Y(3) - CHEMISTRY II**

Chemistry of aromatic compounds with emphasis on synthesis and reactivity; an introduction to spectroscopic techniques in organic chemistry (UV-Visible, IR); characteristics of major biochemical groups such as carbohydrates, proteins, lipids and nucleic acids; types of ligands, basic co-ordination chemistry, stability of complexes; thermochemistry, definition and measurement of heat of reaction, uses of heat of reaction; chemical kinetics, rate of reaction, rate equation, factors affecting rate of reactions, reaction mechanisms; Laws of Thermodynamics and applications; Electrochemistry, half cells, electromotive force, origin and its measurements, applications of standard cell emf's.

**CHEM 2002Y(3) - ANALYTICAL TECHNIQUES II**

Good laboratory practice, analytical process, precision glassware, calibration methods, sampling and sample preparation; complexation & EDTA titrations; fundamentals of spectrophotometry; basic spectroscopy, application of spectrophotometry, spectrophotometers, atomic spectroscopy (absorption; emission; fluorescence), introduction to analytical separations.

**CHEM 2003Y(3) - FOOD AND PHARMACEUTICAL CHEMISTRY**

Food chemistry; composition of food; methods of preserving food; factors for spoilage of foods; milk and dairy products; canning and packaging of meat & fish; food borne infections; food additives; metal contaminants; Structure, nomenclature and properties of pharmaceutical compounds; stability, storage and analysis of pharmaceutical compounds; common pharmaceutical formulations.

**CHEM 2004Y(3) -CHEMICAL SAFETY AND TOXICOLOGY**

Chemical safety; toxicity testing procedures; risk assessments; toxins in food-aflatoxin contaminants; drug toxicity; toxicity in natural and industrial products; chemical hazards

**BIOS 2088Y(3) - MICROBIOLOGY**

History of microbiology, overview of microbial diversity, microbial structures, basic elements of microbial cell structure, infections and diseases caused by microorganisms, laboratory culture and metabolism of microorganisms, including the use of microbiological equipment and the different types of culture media commonly used to isolate pure cultures, methods for the detection and enumeration of microorganisms and the use of GLP in the microbiology laboratory.

**CHEM 2005Y(3) - PRACTICAL CHEMISTRY**

Experiments from the fields of organic, analytical, inorganic and physical chemistry will be carried out. Techniques used will include solvent extraction, distillation, chromatography, titration techniques, use of infrared as analytical techniques.

**CHEM 3001Y(5) - PROJECT**

Research project approved by the department and conducted under the supervision of academic(s) from the department or jointly with other departments of the university.

**CHEM 3002Y(5) - ANALYTICAL TECHNIQUES III**

Chromatography, gas chromatography, GC/MS, high Performance liquid chromatography, HPLC/MS, chromatographic methods and capillary electrophoresis, electrogravimetric and coulometric analysis, voltammetry, X-ray spectroscopy, Far, mid and near IR.

**CHEM 3003Y(5) - ENVIRONMENTAL SCIENCE AND WASTE MANAGEMENT**

Biogeochemistry of major elements (carbon, nitrogen, phosphorus); environmental assessment, ecotoxicity; sediment chemistry; humic substances; PAHs; fatty acids in marine and aquatic environment; hydrogeochemistry; coastal and aquatic pollution; contamination, conservation, environmental and risk management; environment and health; water supply and sanitation; waste water; disposal of waste water; industrial waste water; solid waste management.

**CHEM 3004Y(5) - QUALITY CONTROL AND QUALITY MANAGEMENT**

Quality Assurance, quality control in applied chemical analysis, importance of laboratory accreditation, overview of requirements of ISO/IEC 17025, simple statistical calculations in analytical chemistry, proficiency testing and its interpretation, internal audits in laboratories, hazards analysis critical control point (HACCP), GLP

**CHEM 3005Y(5) - FORENSIC INVESTIGATION AND ANALYSIS**

Analysis of paint and ink, drugs, glass using spectral and analytical techniques; introduction to DNA fingerprinting; introduction of analysis of fire residues.

*January 2010*