FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF CHEMISTRY

LIST OF COURSES OFFERED WITHIN THE DEPARTMENT

CODE	COURSE TITLE
CHEM0901	PRELIMINARY CHEMISTRY A
CHEM0902	PRELIMINARY CHEMISTRY B
CHEM1901	INTRODUCTORY CHEMISTRY A
CHEM1902	INTRODUCTORY CHEMISTRY B
CHEM2010	CHEMICAL ANALYSIS A
CHEM2011	CHEMICAL ANALYSIS LABORATORY I
CHEM2110	INORGANIC CHEMISTRY A
CHEM2111	INORGANIC CHEMISTRY LABORATORY I
CHEM2210	ORGANIC CHEMISTRY A
CHEM2211	ORGANIC CHEMISTRY LABORATORY I
CHEM2310	PHYSICAL CHEMISTRY A
CHEM2311	PHYSICAL CHEMISTRY LABORATORY I
CHEM2402	CHEMISTRY IN OUR DAILY LIVES
CHEM2410	WATER TREATMENT
CHEM2510	FOOD PROCESSING PRINCIPLES I
CHEM2511	FOOD PROCESSING LABORATORY
CHEM2512	FOOD PROCESSING PRINCIPLES II
CHEM3010	CHEMICAL ANALYSIS B
CHEM3011	CHEMICAL ANALYSIS LABORATORY II
CHEM3110	INORGANIC CHEMISTRY B
CHEM3111	INORGANIC CHEMISTRY LABORATORY II
CHEM3112	THE INORGANIC CHEMISTRY OF BIOLOGICAL SYSTEMS
CHEM3210	ORGANIC CHEMISTRY B
CHEM3211	ORGANIC CHEMISTRY LABORATORY II
CHEM3212	NATURAL PRODUCTS CHEMISTRY
CHEM3213	APPLICATIONS OF ORGANIC CHEMISTRY IN MEDICINE & AGRICULTURE
CHEM3310	PHYSICAL CHEMISTRY B
CHEM3311	PHYSICAL CHEMISTRY LABORATORY II
CHEM3312	CHEMISTRY OF MATERIALS
CHEM3313	TOPICS IN ADVANCED PHYSICAL CHEMISTRY
CHEM3401	PROJECT EVALUATION AND MANAGEMENT FOR SCIENCE-BASED INDUSTRIES
CHEM3402	THE CHEMICAL INDUSTRIES
CHEM3403	CHEMICAL PROCESS PRINCIPLES
CHEM3510	FOOD CHEMISTRY I
CHEM3511	FOOD CHEMISTRY LABORATORY
CHEM3512	FOOD CHEMISTRY II
CHEM3513	FOOD SAFETY & QUALITY ASSURANCE
CHEM3610	MARINE AND FRESHWATER CHEMISTRY
CHEM3611	ENVIRONMENTAL CHEMISTRY LABORATORY
CHEM3612	ATMOSPHERIC CHEMISTRY & BIOGEOCHEMICAL CYCLES
CHEM3621	MARINE AND FRESHWATER CHEMISTRY FIELD COURSE
CHEM3711	CHEMISTRY UNDERGRADUATE RESEARCH PROJECT

LIST OF UNDERGRADUATE CHEMISTRY COURSES AND THEIR PREREQUISITES/(COREQUISITES)

CODES	TITLES	CREDIT	SEMESTER OFFERED	LEVEL	PREREQUISITES (COREQUISITES)
PRELIMINARY/ LEVEL 0					
CHEM0901	PRELIMINARY CHEMISTRY A	6-P	1	0	CSEC (CXC) Chemistry Grade III or better or approved equivalents
CHEM0902	PRELIMINARY CHEMISTRY B	6-P	2	0	CSEC (CXC) Chemistry Grade III or better or approved equivalents
LEVEL 1					
CHEM1901	INTRODUCTORY CHEMISTRY A	6	1	1	CHEM0901 and CHEM0902, or CAPE Chemistry, or GCE A-level Chemistry
CHEM1902	INTRODUCTORY CHEMISTRY B	6	2	1	CHEM0901 and CHEM0902, or CAPE Chemistry OR GCE A-level Chemistry
LEVEL 2					
CHEM2010	CHEMICAL ANALYSIS A	3	1	2	CHEM1901 and CHEM1902; FOUN1401 or FOUN1001 with HOD approval
CHEM2011	CHEMICAL ANALYSIS LABORATORY I	2	1	2	CHEM1901 and CHEM1902; FOUN1401 or FOUN1001 with HOD approval; (CHEM2010)
CHEM2110	INORGANIC CHEMISTRY A	3	2	2	CHEM1901 and CHEM1902

CODES	TITLES	CREDIT	SEMESTER OFFERED	LEVEL	PRE-REQUISITES (CO-REQUISITE)
CHEM2111	INORGANIC CHEMISTRY LABORATORY I	2	2	2	CHEM1901 and CHEM1902 (CHEM2110)
CHEM2210	ORGANIC CHEMISTRY A	3	1	2	CHEM1901 and CHEM1902
CHEM2211	ORGANIC CHEMISTRY LABORATORY I	2	1	2	CHEM1901 and CHEM1902 (CHEM2210)
CHEM2310	PHYSICAL CHEMISTRY A	3	1	2	CHEM1901 and CHEM1902
CHEM2311	PHYSICAL CHEMISTRY LABORATORY I	2	2	2	CHEM1901 and CHEM1902 (CHEM2310)
CHEM2402	CHEMISTRY IN OUR DAILY LIVES	3	1	2	CHEM1901 and CHEM1902
CHEM2410	WATER TREATMENT	4	1	2	CHEM1901 and CHEM1902 and Permission of HOD
CHEM2510	FOOD PROCESSING PRINCIPLES I	3	2	2	CHEM1901 and CHEM1902 and Permission of HOD
CHEM2511	FOOD PROCESSING LABORATORY	3	1	2	CHEM1901 and CHEM1902 and Permission of HOD
CHEM2512	FOOD PROCESSING PRINCIPLES II	3	1	2	CHEM1901 and CHEM1902 and Permission of HOD

LEVEL 3					
CODES	**TITLES**	**CREDIT**	**SEMESTER OFFERED**	**LEVEL**	**PRE-REQUISITES (CO-REQUISITE)**
CHEM3010	CHEMICAL ANALYSIS B	3	2	3	CHEM2010
CHEM3011	CHEMICAL ANALYSIS LABORATORY II	2	2	3	CHEM2010 Pass or Fail, but not Fail Absent; CHEM2011; (CHEM3010)
CHEM3110	INORGANIC CHEMISTRY B	3	1	3	CHEM2110
CHEM3111	INORGANIC CHEMISTRY LABORATORY II	2	2	3	CHEM2111 and Permission of HOD; (CHEM3112 or CHEM3312)
CHEM3112	THE INORGANIC CHEMISTRY OF BIOLOGICAL SYSTEMS	3	2	3	CHEM2110, CHEM2111 and CHEM3110
CHEM3210	ORGANIC CHEMISTRY B	3	2	3	CHEM2210, Pass or Fail, but not Fail Absent
CHEM3211	ORGANIC CHEMISTRY LABORATORY II	2	2	3	CHEM2210, CHEM2211 and CHEM3210 and Permission of HOD; (CHEM3212 or CHEM3213)
CHEM3212	NATURAL PRODUCTS CHEMISTRY	3	2	3	CHEM2210, CHEM2211 and CHEM3210 and Permission of HOD
CHEM3213	APPLICATIONS OF ORGANIC CHEMISTRY IN MEDICINE & AGRICULTURE	3	1	3	CHEM2210, CHEM2211 and CHEM3210 and Permission of HOD
CHEM3310	PHYSICAL CHEMISTRY B	3	2	3	CHEM2310, Pass or Fail, but not Fail Absent

CODES	TITLES	CREDIT	SEMESTER OFFERED	LEVEL	PREREQUISITES (COREQUISITES)
CHEM3311	PHYSICAL CHEMISTRY LABORATORY II	2	1	3	CHEM2311 and Permission of HOD; (CHEM3312 or CHEM3313)
CHEM3312	CHEMISTRY OF MATERIALS	3	1	3	CHEM2310 and CHEM2110 and Permission of HOD
CHEM3313	TOPICS IN ADVANCED PHYSICAL CHEMISTRY	3	2	3	CHEM2310 and CHEM3310 and Permission of HOD
CHEM3401	PROJECT EVALUATION AND MANAGEMENT FOR SCIENCE BASED INDUSTRIES	4	1	3	*This course is only available to students majoring in Applied Chemistry and Food Chemistry but students who do not have any overlapping Management Studies courses and are majoring in areas which have an industrial direction and have the approval of the Department within which they are majoring may be allowed to take this course.* CHEM2510 + CHEM2511 or CHEM3402
CHEM3402	THE CHEMICAL INDUSTRIES	4	2	2	Any two of CHEM2010+CHEM2011, CHEM2110, CHEM2210+CHEM2211 or CHEM2310; Permission of HOD
CHEM3403	CHEMICAL PROCESS PRINCIPLES	8	2	3	CHEM2310 and CHEM2311 and Permission of HOD
CHEM3510	FOOD CHEMISTRY I	3	1	3	CHEM2010 + CHEM2011 and CHEM2210 + CHEM2211 and Permission of HOD

CODES	TITLES	CREDIT	SEMESTER OFFERED	LEVEL	PRE-REQUISITES (CO-REQUISITE)
LEVEL 3					
CHEM3511	FOOD CHEMISTRY LABORATORY	3	2	3	Permission of HOD; (CHEM3510 and CHEM3512)
CHEM3512	FOOD CHEMISTRY II	3	2	3	CHEM2010 + CHEM2011 and CHEM2210 + CHEM2211 and Permission of HOD
CHEM3513	FOOD SAFETY & QUALITY ASSURANCE	3	2	3	CHEM2510 **OR** CHEM2512 and Permission of HOD
CHEM3610	MARINE AND FRESHWATER CHEMISTRY	3	1	3	CHEM2010, CHEM2011 and any one of the following: CHEM2110, CHEM2210, CHEM2310 or CHEM3010
CHEM3611	ENVIRONMENTAL CHEMISTRY LABORATORY	2	1	3	Permission of HOD; (CHEM3610)
CHEM3612	ATMOSPHERIC CHEMISTRY & BIOGEOCHEMICAL CYCLES	6	2	3	CHEM3610; Permission of HOD
CHEM3621	MARINE AND FRESHWATER CHEMISTRY FIELD COURSE	2	2	3	CHEM3610; Permission of HOD
CHEM3711	CHEMISTRY UNDERGRADUATE RESEARCH PROJECT	6	1 & 2 or 2 & 3	3	Majoring in Chemistry; 20 Advanced Credits in Chemistry and Permission of HOD

FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF CHEMISTRY

The following programmes are available to students taking Level II Chemistry courses for the first time in 2014/15.

B.Sc. Degrees

Chemistry and Management
Chemistry with Education
Special Chemistry

Majors

General Chemistry
Applied Chemistry
Environmental Chemistry
Food Chemistry

Minors

General Chemistry
Environmental Chemistry
Food Chemistry
Food Processing
Industrial Chemistry

NOTE:

1. ALL majors and degrees in Chemistry require SIX credits of Level 1 Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Mathematics courses include:
   MATH1185 – Calculus for Scientists and Engineers
   MATH1141 - Introduction to Linear Algebra & Analytical Geometry
   MATH1142 – Calculus I
   MATH1151 – Calculus II
   MATH1152 – Introduction to Formal Mathematics
   STAT1001 – Statistics for Scientists

   Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for the Advanced Chemistry courses.

   Students require MATH1141, MATH1142, MATH1151 and MATH1152 if they wish to pursue advanced courses in Mathematics.

B.Sc. MAJOR IN GENERAL CHEMISTRY

Programme Summary/Overview:

The General Chemistry major provides students with considerable background in chemistry through courses focused on analytical, inorganic, organic and physical chemistry. The major allows students to have an emphasis in one of these sub-disciplines or to broaden their studies by choosing electives from applied, environmental and/or food chemistry. Students benefit from a balanced overview of chemical concepts and of critical topics in contemporary chemistry and sustainable development. The Chemistry major prepares graduates to be critical thinkers, effective communicators and good team players and provides a solid foundation for building careers in the chemical sector, research, allied technical areas or other fields.

Programme Rationale:

Many national and global issues of the 21st century are inextricably associated with chemistry, and their exploration and resolution entail the application of chemical principles and techniques. Among these issues are renewable energy sources, global warming, management of natural resources, supply of potable water, food production, crime detection, drug development and sustainable development. The major in General Chemistry provides students with the skills and knowledge that will serve as a solid foundation to make sound evidence-based decisions and to engage critically with contemporary scientific issues. The major provides a path to a wide range of careers in science, medicine and research.

Programme Aims:

The Major in General Chemistry aims to equip students with the necessary skills to be able to:

- Explain the properties and reactivity of chemicals, design syntheses of a range of organic and inorganic materials, plan and safely conduct chemical investigations and make measurements to solve theoretical and practical problems.
- Use appropriate analytical techniques to detect, quantify, isolate, purify, and characterize inorganic and organic materials and to explain the theoretical and instrumental bases of these techniques.
- Effectively work alone or within teams to carry out chemical investigations, evaluate scientific data and communicate findings both orally and in writing, using appropriate technical language.
- Recognize the interrelatedness of chemistry and other scientific disciplines and apply knowledge of chemistry to solving problems related to industry, environment or processing.

Programme Structure and Content:

The General Chemistry major consists of 39 credits of advanced chemistry which build on the 12 credits of broad based Level I chemistry and 6 credits of Level I mathematics. The 20 required Level II credits consist of core courses in analytical, inorganic, organic and physical chemistry (A, I, O and P) and include 8 credits in laboratory courses which span the four sub-disciplines. At Level III, students take 10 credits of core chemistry (inclusive of 4 credits in laboratory courses) and 9 credits in electives.

The course requirements and structure are as tabulated below.

Semester I	Semester II
LEVEL I : 18 compulsory credits	
CHEM1901 – Introductory Chemistry A (6 credits) MATH - 6 credits from any Level I Mathematics courses (taken in Semester 1 and/or Semester 2)	CHEM1902 – Introductory Chemistry B (6 credits) FOUN1014: Critical Reading and Writing in Science and Technology and Medical Sciences (taken in Semester 1 or Semester 2) (3 credits)
The following 20 Level II credits	
CHEM2010 – Chemical Analysis A (3 credits) CHEM2011 – Chemical Analysis Laboratory I (2 credits) CHEM2210 – Organic Chemistry A (3 credits) CHEM2211 – Organic Chemistry Laboratory I (2 credits) CHEM2310 – Physical Chemistry A (3 credits)	CHEM2110 – Advanced Inorganic Chemistry A (3 credits) CHEM2111 – Inorganic Chemistry Laboratory I (2 credits) CHEM2311 – Physical Chemistry Laboratory I (2 credits)
at least 6 Level III credits from	
CHEM3110 – Advanced Inorganic Chemistry B (3 credits)	CHEM3010– Chemical Analysis B (3 credits) CHEM3210 – Organic Chemistry B (3 credits) CHEM3310 – Physical Chemistry B (3 credits)
at least 4 Level III credits from	
CHEM3311 – Physical Chemistry Laboratory II (2 credits) CHEM3111 – Inorganic Chemistry Laboratory II (2 credits)	CHEM3211– Organic Chemistry Laboratory II (2 credits) CHEM3011- Chemical Analysis Laboratory II (2 credits)
and at least 3 Level III credits from	
CHEM3213 –Applications of Organic Chemistry in Medicine & Agriculture (3 credits) CHEM3312 – Chemistry of Materials (3 credits)	CHEM3112 – The Inorganic Chemistry of Biological Systems (3 credits) CHEM3212 – Natural Products Chemistry (3 credits) CHEM3313 - Topics In Advanced Physical Chemistry (3 credits)
and 6 additional Level II/III credits from listed electives	

List of Chemistry Electives

Course code	Course title	# of credits
CHEM2410	Water Treatment	4
CHEM2510	Food Processing Principles I	3
CHEM2511	Food Processing Laboratory	3
CHEM2512	Food Processing Principles II	3
CHEM3112	The Inorganic Chemistry of Biological Systems	3
CHEM3212	Natural Products Chemistry	3
CHEM3213	Applications of Organic Chemistry in Medicine & Agriculture	3
CHEM3312	Chemistry of Materials	3
CHEM3313	Topics In Advanced Physical Chemistry	3
CHEM3402	The Chemical Industries	4
CHEM3510	Food Chemistry I	3
CHEM3512	Food Chemistry II	3
CHEM3610	Marine & Freshwater Chemistry	3
CHEM3612	Atmospheric Chemistry & Biogeochemical Cycles	6
CHEM3111	Inorganic Chemistry Laboratory II	2
CHEM3211	Organic Chemistry Laboratory II	2
CHEM3311	Physical Chemistry Laboratory II	2
CHEM3511	Food Chemistry Laboratory	2
CHEM3611	Environmental Chemistry Laboratory	2
CHEM3621	Marine and Freshwater Chemistry Field Course	2
CHEM3711	Chemistry Undergraduate Research Project	6

NOTE:

1. The General Chemistry major requires SIX credits of Level 1 Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Mathematics courses include:
   MATH1185 – Calculus for Scientists and Engineers
   MATH1141 - Introduction to Linear Algebra & Analytical Geometry
   MATH1142 – Calculus I
   MATH1151 – Calculus II
   MATH1152 – Introduction to Formal Mathematics
   STAT1001 – Statistics for Scientists

   Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for the Advanced Chemistry courses.

   Students require MATH1141, MATH1142, MATH1151 and MATH1152 if they wish to pursue advanced courses in Mathematics.

B.Sc. MAJOR IN APPLIED CHEMISTRY

Programme Summary/Overview:

The modern chemical industry requires professionals with sound knowledge of chemistry and analytical principles and in addition, the chemist in industry must be able to combine aspects of chemistry, engineering and materials science to economically make products that meet quality standards without breaching environmental regulations. The major in Applied Chemistry seeks to prepare students to effectively master the multiple roles involved in the application of chemistry in industry.

Programme Rationale:

Chemical industries require a wide variety of technical and specialist skills in order to produce the diverse range of products that they manufacture. The major in Applied Chemistry is designed to prepare students for the multiple roles that the chemist in industry must fulfill. The major covers the chemistry and unit operations of selected chemical industries and uses an internship programme to demonstrate the application of chemical principles within the manufacturing environment. Strong involvement of industry personnel in the course delivery ensures that students are exposed to practical aspects of chemical processing and are prepared to assume responsible roles upon completion of the programme.

Programme Aims:

The B.Sc. Major in Applied Chemistry aims to equip students with the necessary skills to be able to:

- Design chemical syntheses, safely conduct chemical investigations and accurately record and assess the quality of the data generated.
- Use appropriate analytical techniques to detect, quantify and isolate analytes and to characterize materials or assess the quality of products and raw materials.
- Evaluate the major steps involved in selected industrial processes, rationalize their unit operations and use chemical principles to describe the chemical changes that occur.
- Demonstrate understanding of basic chemical engineering and physiochemical principles and apply these to explaining properties of chemicals and materials within industrial processes.
- Use chemical and physical theory to describe the movement of chemicals and materials within and between unit operations.
- Recognize the interrelatedness of chemistry, chemical engineering and other scientific disciplines and apply knowledge of chemistry to solving problems related to industry, environment or processing.

Programme Structure and Content:

The major in Applied Chemistry comprises 33 credits of Chemistry, comprising 30 credits of specified Applied Chemistry courses and a minimum of 3 credits in electives. The major is supported by 10 credits of General and Analytical Chemistry courses which provide the fundamental principles on which the chemical reactions and unit operations that dominate industrial chemical manufacture are discussed. Year I covers basic courses in Chemistry, Mathematics and Writing. In Year II, the theory and practice of analytical and physical chemistry are studied along with courses on water treatment and industrial chemistry (which requires an internship within an approved chemical industry). In Year III, courses on the business and management of science-based industries complement courses on environmental chemistry and unit operations in the chemical industry.

The programme requirements and structure are as tabulated below.

Semester I	Semester II
YEAR I : 21 compulsory credits	
CHEM1901 – Introductory Chemistry A (6 credits) MATH - 6 credits from any Level 1 Mathematics courses (taken in Semester 1 and/or Semester 2).	CHEM1902 – Introductory Chemistry B (6 credits) FOUN1014 - Critical Reading and Writing in Science and Technology and Medical Science. (taken in Semester 1 or Semester 2) (3 credits)
YEAR II: 23 compulsory credits	
CHEM2010 – Chemical Analysis A (3 Credits) CHEM2011 – Chemical Analysis Laboratory I (2 Credits) CHEM2310 – Physical Chemistry A (3 Credits) CHEM2410 – Water Treatment (4 Credits)	CHEM2311 – Physical Chemistry Laboratory I (2 credits) CHEM3010 – Chemical Analysis B (3 Credits) CHEM3011– Chemical Analysis Laboratory II (2 Credits) CHEM3402 – The Chemical Industries (4 Credits)
CHEM2010, CHEM2011, CHEM2310 & CHEM2311 may be counted as elective credits.	
YEAR III: 11 compulsory credits	
CHEM3401 – Project Evaluation & Management for Science Based Industries (4 Credits) CHEM3610 – Marine and Freshwater Chemistry (3 Credits) CHEM3611 – Marine and Freshwater Chemistry Laboratory (2 Credits)	CHEM3403 – Chemical Process Principles (8 Credits)
Major requires 30 credits of specified Applied Chemistry courses along with one Level II/III elective (≥ 3 credits). Ten credits of prerequisite General Chemistry courses (CHEM2010, CHEM2011, CHEM2310 & CHEM2311) are also required.	

List of Chemistry electives

Course code	Course title	# of credits
CHEM2510	Food Processing Principles I	3
CHEM2511	Food Processing Laboratory	3
CHEM2512	Food Processing Principles II	3
CHEM3110	Inorganic Chemistry B	3
CHEM3112	The Inorganic Chemistry of Biological Systems	3
CHEM3210	Organic Chemistry B	3
CHEM3212	Natural Products Chemistry	3
CHEM3213	Applications of Organic Chemistry in Medicine & Agriculture	3
CHEM3310	Physical Chemistry B	3
CHEM3312	Chemistry of Materials	3
CHEM3313	Topics In Advanced Physical Chemistry	3
CHEM3510	Food Chemistry I	3
CHEM3512	Food Chemistry II	3
CHEM3513	Food Safety & Quality Assurance	3
CHEM3621	Marine & Freshwater Chemistry Field Course	2
CHEM3711	Chemistry Undergraduate Research Project	6

NOTE:

1. The Applied Chemistry major requires SIX credits of Level 1 Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Mathematics courses include:
   MATH1185 – Calculus for Scientists and Engineers
   MATH1141– Introduction to Linear Algebra & Analytical Geometry
   MATH1142 – Calculus I
   MATH1151 – Calculus II
   MATH1152 – Introduction to Formal Mathematics
   STAT1001 – Statistics for Scientists

   Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for Advanced Chemistry courses.

   Students require MATH1141, MATH1142, MATH1151 and MATH1152 if they wish to pursue advanced courses in Mathematics.

B.Sc. MAJOR IN ENVIRONMENTAL CHEMISTRY

Programme Summary/Overview:

Environmental Chemistry involves study of the chemical composition of the various spheres of planet Earth, the transport of chemicals within and between those spheres and the chemical changes that occur within them. It also involves the study of the impact of human activities on the environment and how adverse changes may be controlled and mitigated to promote sustainable development. The Environmental Chemistry major seeks to produce graduates with good basic chemical knowledge and the ability to apply that knowledge to environmental issues. The major seeks to prepare graduates who will be critical thinkers, effective communicators and good team players within the chemical sector, related private and public enterprises and research institutions.

Programme Rationale:

Globally, regionally and locally, many aspects of the chemistry of our environment are in a critical position. The need for sustainable economic development and national prosperity has to be balanced carefully with environmental protection. The major in Environmental Chemistry is therefore designed to prepare an informed cohort of scientists who understands and is able to address some of the important factors that impact the environment.

Programme Aims:

At the end of the programme, students should be able to:

- Apply fundamental general chemistry principles to an understanding of key chemical reactions and processes that take place within the natural environment.
- Use suitable analytical techniques to detect analytes of interest, quantify concentrations of selected species and evaluate impacts on environmental processes and natural reactions.
- Describe the structures of the various spheres of the environment, classify the chemical reactions that predominate in each and apply simple biogeochemical models to predict the impact and fate of chemicals in the environment.
- Identify important global, regional and national environmental issues, explain the chemistry behind those issues and link them to sustainable development.
- Effectively work alone or within teams to carry out chemical investigations within the laboratory or in different spheres of the environment, accurately collect and evaluate scientific data and communicate findings both orally and in writing, using appropriate technical language.

Programme Structure and Content:

The Environmental Chemistry major comprises 24 credits of specialized courses and 6 credits of approved environment-related electives and is supported by 18 credits of critical General and Analytical Chemistry prerequisite courses. The prerequisites cover the fundamental concepts on which characteristics of the environment and its natural reactions are based. The required courses address the treatment and management of water resources, the principles and characteristics of aquatic and marine environments and detail key reactions and processes that occur in the atmosphere. Approaches to modeling aspects of the environment are presented and strategies that promote environmental sustainability are introduced.

The programme requirements and structure are as tabulated below.

Semester I	Semester II
YEAR I : 21 compulsory credits	
CHEM1901 – Introductory Chemistry A (6 credits) MATH - 6 credits from any Level 1 Mathematics courses (taken in Semester 1 and/or Semester 2).	CHEM1902 – Introductory Chemistry B (6 credits) FOUN1014 - Critical Reading and Writing in Science and Technology and Medical Sciences. (3 credits) (taken in Semester 1 or Semester 2)
YEAR II: 27 compulsory credits	
CHEM2010 – Chemical Analysis A (3 Credits) CHEM2011 – Chemical Analysis Laboratory I (2 Credits) CHEM2210 – Organic Chemistry A (3 credits) CHEM2310 – Physical Chemistry A (3 Credits) CHEM2410 – Water Treatment (4 Credits)	CHEM3010 – Chemical Analysis B (3 Credits) CHEM3011 – Chemical Analysis Laboratory II (2 Credits) CHEM3402 – The Chemical Industries (4 Credits) CHEM2110 – Inorganic Chemistry A (3 Credits)
YEAR III: 11 compulsory credits	
CHEM3610 – Marine and Freshwater Chemistry (3 Credits) CHEM3611 – Marine and Freshwater Chemistry Laboratory (2 Credits)	CHEM3612 – Atmospheric Chemistry & Biogeochemical Cycles (6 Credits)
The Environmental Chemistry Major requires 24 credits of specified Environmental courses along with 6 credits from Level II/III approved environment related electives. There are 14 credits of defined prerequisite courses (CHEM2010, CHEM2011, CHEM2110, CHEM2210, CHEM2310); an additional 4 credits from Level II laboratory electives (CHEM2111, CHEM2211 or CHEM2311) are also required.	

Courses (Chemistry and other subjects) suitable as Electives for the Environmental Chemistry Major

Course code	Course title	# of credits
CHEM3621	Marine and Freshwater Chemistry Field Course	2
CHEM3711	Chemistry Undergraduate Research Project	6
BIOL2402	Fundamentals of Biometry	3
BIOL2403	Principles of Ecology	3
BIOL3405	Pest Ecology and Management	3
BIOL3406	Freshwater Biology	3
BIOL3407	Oceanography	3
BIOL3408	Coastal Systems	3
BIOL3409	Caribbean Coral Reefs	3
BIOL3410	Water Pollution Biology	3
BOTN3403	Fundamentals of Horticulture	3
BOTN3404	Economic Botany	3
BOTN3405	Plant Ecophysiology	3
BIOL2402	Fundamentals of Biometry	3
BIOL2403	Principles of Ecology	3
GEOG2131	Urban Geography	3
GEOG2232	Environmental Change	3
GEOG3132	Tourism Planning & Development	3
GGEO2233	Water Resources	3
GGEO3232	Climate Change in the Tropics	3
GGEO3233	Hydrology and Hydrological Geology	3
GGEO3332	Disaster Management	3
GGEO2232	Introduction to Geographic Information Systems	3
PHYS3661	Physics of the Atmosphere and Climate	3
PHYS3671	Solar Power	3
PHYS3681	Wind and Hydro Power	3

NOTE:

1. Students must ensure that they satisfy the prerequisite courses required for entry to the electives of interest in the list above. In most instances, 12 Level I credits in the subject of interest are required. One or more advanced courses may also be needed.

2. The Environmental Chemistry major requires SIX credits of Level 1 Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Mathematics courses include:
   MATH1185 – Calculus for Scientists and Engineers
   MATH1141 - Introduction to Linear Algebra & Analytical Geometry
   MATH1142 – Calculus I
   MATH1151 – Calculus II
   MATH1152 – Introduction to Formal Mathematics
   STAT1001 – Statistics for Scientists

   Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for Advanced Chemistry courses.

   Students require MATH1141, MATH1142, MATH1151 and MATH1152 if they wish to pursue advanced courses in Mathematics.

B.Sc. MAJOR IN FOOD CHEMISTRY

Programme Summary/Overview:

The Food Chemistry major applies several of the principles covered in the General Chemistry and Analytical Chemistry courses to an understanding of the structure and properties of food components, the effects of processing and storage and to issues of food safety and quality. The programme is designed to produce critical thinkers with industry-ready skills and effective communicators who have an appreciation of the importance of good ethics in the practice of science.

Programme Rationale:

Food security is a primary global concern and is fundamental to the sustainable development of any nation. In order to produce more diverse, safe and nutritious foods to meet the region's food supply needs, it is important that local capacity in food science and technology be improved. This programme seeks to prepare students to become professionals in the local and regional Food Processing Industries (FPI) and related enterprises and to engage in research on issues relevant to the FPI.

Programme Aims:

The B.Sc. Major in Food Chemistry aims to enable students to:

- Apply General Chemistry principles to explain the properties and reactivity of chemicals, design syntheses of selected compounds and safely conduct chemical investigations either alone or as part of a team.
- Use appropriate analytical techniques to detect, quantify, isolate, purify, and characterize materials and to explain the theoretical and instrumental bases of these techniques.
- Apply scientific principles to the harvesting, processing, preservation, storage and consumption of foods and demonstrate knowledge of the general characteristics of raw food materials.
- Employ engineering concepts and unit operations used in food processing and apply principles and techniques necessary for quantitative, physical, chemical and biological analyses of foods.
- Discuss the relationships between various food components and health and demonstrate how food science can be integrated with business to spawn profitable food enterprises.
- Discuss recent developments in the local and global FPI, and solve problems related to food processing, preservation and analysis.

Programme Structure and Content:

The Food Chemistry major comprises 34 credits of specialized courses and is supported by 13 credits of critical General and Analytical Chemistry prerequisite courses which cover the fundamental concepts on which the scientific principles, characteristics, preservation and quality of foods are based. Following 12 credits of Level I Chemistry, the Level II courses cover central areas of organic and physical chemistry concepts, chemical analysis, water treatment and food processing technologies. At Level III, the required courses explore instrumental methods applied in the analyses of foods, chemistry of food components, quality assurance, food safety and the integration of business and management in the food industry.

The course requirements and structure are as tabulated below:

Semester I	Semester II
LEVEL I (Year 1): 18 compulsory credits	
CHEM1901 – Introductory Chemistry A (6 Credits) MATH- 6 credits from any Level 1 Mathematics courses (taken in Semester 1 and/or Semester 2).	CHEM1902 – Introductory Chemistry B (6 Credits) FOUN1014: Critical Reading and Writing in Science and Technology and Medical Science (3 credits, taken in Semester 1 or Semester 2)
ADVANCED LEVEL (Year 2): 24 credits	
CHEM2010 – Chemical Analysis A (3 Credits) CHEM2011 – Chemical Analysis Laboratory I (2 Credits) CHEM2210 – Organic Chemistry A (3 Credits) CHEM2211 – Organic Chemistry Laboratory I (2 Credits) CHEM2511 – Food Processing Laboratory (3 Credits) CHEM2512 – Food Processing Principles II (3 Credits)	CHEM2510 – Food Processing Principles I (3 Credits) CHEM3010 – Chemical Analysis B (3 Credits) CHEM3011 – Chemical Analysis Laboratory II (2 Credits)
ADVANCED LEVEL (Year 3): 23 credits	
CHEM2310 – Physical Chemistry A (3 Credits) CHEM2410 – Water Treatment (4 Credits) CHEM3401 – Project Evaluation & Management for Science Based Industries (4 Credits) CHEM3510 – Food Chemistry I (3 Credits)	CHEM3511 – Food Chemistry Lab (3 Credits) CHEM3512 – Food Chemistry II (3 Credits) CHEM3513 – Food Safety & Quality Assurance (3 Credits)
Major = 34 credits of specialized Food Chemistry courses supported by 13 prerequisite credits of General Chemistry (CHEM2010, CHEM2011, CHEM2210, CHEM2211 & CHEM2310)	

NOTE: The Food Chemistry major requires SIX credits of Level 1 Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Math courses include:
MATH1185 – Calculus for Scientists and Engineers
MATH1141 - Introduction to Linear Algebra & Analytical Geometry
MATH1142 – Calculus I
MATH1151 – Calculus II
MATH1152 – Introduction to Formal Mathematics
STAT1001 – Statistics for Scientists

Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for Advanced Chemistry courses.

MINOR IN GENERAL CHEMISTRY

Programme Summary/Overview:

The General Chemistry minor gives students a foundation in analytical chemistry and two of the other traditional sub-disciplines (inorganic, organic and physical chemistry). The minor is comprised of 9 credits of theory and 6 credits of laboratory from Level II core courses.

Programme Rationale:

A General Chemistry minor is offered for those students who desire a structured background in basic chemistry theory and practice to complement their majors in other disciplines. It enhances the flexibility and profile of students as they seek employment or pursue further studies.

The course requirements and structure are as tabulated below.

Semester I	Semester II
LEVEL I : 18 compulsory credits	
CHEM1901 – Introductory Chemistry A (6 credits) FOUN1014: Critical Reading and Writing in Science and Technology and Medical Sciences (3 credits) (taken in Semester I or Semester 2)	CHEM1902 – Introductory Chemistry B (6 credits)
At least 15 advanced credits in Chemistry which must include:	
CHEM2010 –Chemical Analysis A (3 Credits) CHEM2011 –Chemical Analysis Laboratory I (2 Credits)	
and at least 6 credits from:	
CHEM2210 – Organic Chemistry A (3 Credits) CHEM2310 – Physical Chemistry A (3 Credits)	CHEM2110 – Inorganic Chemistry A (3 Credits)
and at least 4 credits from:	
CHEM2211 – Organic Chemistry Laboratory I (2 Credits)	CHEM2111– Inorganic Chemistry Laboratory I (2 Credits) CHEM2311 – Physical Chemistry Laboratory I (2 Credits)

MINOR IN ENVIRONMENTAL CHEMISTRY

Programme Summary/Overview:

An Environmental Chemistry minor is offered for those students who desire to complement their major with a basic introduction to the role of Chemistry in the study of the environment. The minor is available to both Chemistry and non-Chemistry majors but some of the environmental courses have General Chemistry pre-requisites which will have to be satisfied. The minor enhances the flexibility and profile of students as they seek employment or pursue further studies.

Programme Rationale:

Globally, regionally and locally, many aspects of the chemistry of our environment are in a critical position. The need for sustainable economic development and national prosperity has to be balanced carefully with environmental protection. The minor in Environmental Chemistry seeks to help to prepare an informed cohort of scientists to understand and address environmental issues and manage environmental monitoring programmes.

Programme Structure and Content:

This programme consists of 15 compulsory Advanced (Level II/Level III) credits as listed in the table below. The pre-requisites for these courses are:

CHEM1901, CHEM1902 & FOUN1014;
CHEM2010, CHEM2011;
any one of CHEM2110, CHEM2210, CHEM2310, CHEM3010.

Advanced courses for the Environmental Chemistry Minor

Semester I	Semester II
LEVEL II 4 required credits	
CHEM2410 – Water Treatment (4 Credits)	
LEVEL III 11 required credits	
CHEM3610 – Marine and Freshwater Chemistry (3 Credits) CHEM3611 – Marine and Freshwater Chemistry Laboratory (2 Credits)	CHEM3612 – Atmospheric Chemistry & Biogeochemical Cycles (6 Credits)

MINOR IN FOOD CHEMISTRY

Programme Summary/Overview:

The Food Chemistry minor explores the chemistry and functionality of food components and seeks to demonstrate how food properties may be manipulated or controlled in the processing, production and storage of food products. In addition, it examines the contribution of the food components to nutrition and health. Students completing this programme will be equipped to make positive contributions to the advancement of the Food Processing Industries and in the areas of food analysis and research.

Programme Rationale:

Food science, multidisciplinary in nature, demonstrates the integration of disciplines necessary to convert food from farm to table. The food chemistry minor is intended to complement majors in other scientific disciplines and exposes students to the applied science of food affording them the opportunity to become a valued team member in the food-related sector.

Programme Structure and Content:

This programme consists of 16 Advanced Level (II/III) credits. The required Level III courses (9 credits) explore the chemistry of food components while the additional 7 credits may be selected from Level II or Level III courses that cover central areas of organic and physical chemistry, chemical analysis, water treatment, instrumental methods or food safety.

The course requirements and structure are as tabulated below:

Semester I	Semester II
At least 16 advanced credits in Chemistry which must include:	
CHEM3510 – Food Chemistry I (3 Credits)	CHEM3511 – Food Chemistry Laboratory (3 Credits) CHEM3512 – Food Chemistry II (3 Credits)
and at least 7 credits from:	
CHEM2010 –Chemical Analysis A (3 Credits) CHEM2011 –Chemical Analysis Laboratory I (2 Credits) CHEM2210 – Organic Chemistry A (3 Credits) CHEM2211 – Organic Chemistry Laboratory I (2 Credits) CHEM2310 – Physical Chemistry A (3 Credits) CHEM2410 – Water Treatment (4 Credits)	CHEM2311 – Physical Chemistry Laboratory I (2 Credits) CHEM3010 – Chemical Analysis B (3 Credits) CHEM3011 – Chemical Analysis Laboratory II (2 Credits) CHEM3210 – Organic Chemistry B (3 Credits) CHEM3513 – Food Safety & Quality Assurance (3 Credits)

MINOR IN FOOD PROCESSING

Programme Summary/Overview:

The Food Processing minor seeks to provide the knowledge and skills necessary for implementing the safe production of good quality processed foods. It details the factors that affect food deterioration and the measures that may be employed in controlling them and builds understanding of engineering concepts and unit operations that are critical to food manufacture.

Programme Rationale:

The Food Processing minor is designed to afford students who specialize in other disciplines experience in the application of food processing technologies. These individuals will be equipped to apply a wide range of food processing techniques and to combine these skills with other competencies developed though their major.

Programme Structure and Content:

This programme consists of 16 Advanced Level (II/III) credits. The compulsory Level II courses (9 credits) explore the theory of various food processing technologies, laboratory analyses of raw and processed foods as well as pilot scale processing of local foods. The additional 7 credits may be selected from Level II or Level III courses that cover central areas of physical chemistry, water treatment, industrial chemistry, unit operations, food safety and the integration of business and management in the food industry.

The course requirements and structure are as tabulated below:

Semester I	Semester II
At least 16 advanced credits in Chemistry which must include:	
CHEM2512 – Food Processing Principles II (3 Credits) CHEM2511 – Food Processing Laboratory (3 Credits)	CHEM2510 – Food Processing Principles I (3 Credits)
and at least 7 credits from	
CHEM2310 – Physical Chemistry A (3 Credits) CHEM2410 – Water Treatment (4 Credits) CHEM3401 – Project Evaluation & Management for Science Based Industries (4 Credits)	CHEM2311 – Physical Chemistry Laboratory I (2 Credits) CHEM3402 – The Chemical Industries (4 Credits) CHEM3513 – Food Safety & Quality Assurance (3 Credits) CHEM3403 – Chemical Process Principles (8 Credits)

MINOR IN INDUSTRIAL CHEMISTRY

Programme Summary/Overview:

An Industrial Chemistry minor is offered for those students who desire to complement their major with a basic introduction to industrial chemical processing. The minor is available to both Chemistry and non-Chemistry majors but some of the industrial courses have General Chemistry prerequisites which must be met. The minor enhances the flexibility and profile of students as they seek employment or pursue further studies.

Programme Rationale:

The minor in Industrial Chemistry is designed to provide the essentials of chemical process operations to students who seek to specialize in other areas of study. The minor covers the chemistry and unit operations of selected chemical industries and uses an internship programme to demonstrate the application of chemical principles within the manufacturing environment. Majors in General Chemistry may incorporate the Industrial Chemistry minor into their course of study to diversify their training or increase their employment opportunities.

Programme Structure and Content:

This minor in Industrial Chemistry consists of 16 compulsory advanced credits. A 4-credit course covers the organization and operation of critical chemical industries and provides for internship within an approved chemical industry while courses in project management (4 credits) and chemical unit operations (8 credits) round out the required courses.

Advanced courses for the Environmental Chemistry Minor

Semester I	Semester II
16 required credits	
CHEM3401 – Project Evaluation & Management for Science Based Industries (4 Credits)	CHEM3402 – The Chemical Industries (4 Credits) CHEM3403 – Chemical Process Principles (8 Credits)
CHEM2010, CHEM2011, CHEM2310 and CHEM2311 are prerequisites for CHEM3403.	

DEPARTMENT OF CHEMISTRY

In addition to majors and minors outlined above, the Department offers the following B.Sc. programmes:

- **Chemistry and Management**
- **Chemistry with Education**
- **Special Chemistry**

B.Sc. CHEMISTRY AND MANAGEMENT

Programme Overview:
This is a fully integrated programme in which the core chemistry courses are combined with courses from the Department of Management Studies. Students gain knowledge of the principles and applications of chemistry and of business management. Graduates from this degree are competent in both technical and business related areas and can communicate effectively with scientists, technocrats and business managers. Students are prepared for careers in industry, regulatory agencies, chemical laboratories, marketing, business management or entrepreneurship.

Programme Rationale:
There is increased demand for graduates with a sound knowledge of science who are also equipped to manage and operate a business or organization. This programme provides graduates with the knowledge, skills and competencies in chemistry, finance, marketing, entrepreneurship and organizational management and prepares them to not only create employment for themselves, but for others as well.

Programme Aims

The B.Sc. degree in Chemistry and Management aims to equip students with the necessary skills to be able to:

- Use General Chemistry principles to explain the properties and reactivity of chemicals, plan and safely conduct chemical investigations and make measurements to solve theoretical and practical problems.
- Use appropriate analytical techniques to detect, quantify, isolate, purify, and characterize selected materials and to explain the principles on which the techniques are based.
- Effectively work alone or within teams to apply chemistry and management skills in scientific processes.
- Effectively manage and utilize human, material and financial resources and optimize business processes for efficient operation of an enterprise or for establishment of small businesses.
- Communicate effectively both orally and in writing with both scientists and non-scientists and make sound, technical, managerial and ethical decisions based on thorough analysis of available information.
- Function as effective managers in the chemical or technical industries or in businesses that emphasize innovativeness in driving growth and prosperity.

Programme Structure and Content:

This programme consists of 65 Advanced (Level II/level III) credits taken from Chemistry courses (32 credits) and Management Studies (33 credits).

Semester I	Semester II
LEVEL I : 36 compulsory credits (12 credits of Chemistry courses plus 6 credits of Mathematics plus 18 credits from Management Studies)	
CHEM1901: Introductory Chemistry A (6 credits) STAT1001: Statistics for Scientists (3 credits) Plus an additional Level 1 Mathematics course (3 credits) (taken EITHER in Semester I or Semester 2)	CHEM1902: Introductory Chemistry B (6 credits) FOUN1014: Critical Reading and Writing in Science and Technology and Medical Science (3 credits) (taken in EITHER Semester I or Semester 2)
	PSYC1002:Introduction to Industrial and Organizational Psychology (3 credits) ECON1012:Principles of Economics II (3 credits)
From either Semester 1 or Semester 2 ACCT1003:Introduction to Cost and Management Accounting (3 credits) ACCT1005:Introduction to Financial Accounting (3 credits) ECON1000:Principles of Economics (3 credits) SOCI1002:Sociology for the Caribbean (3 credits)	
Level II : 41 compulsory credits **(20 credits of Chemistry and 21credits from Management Studies)**	
CHEM2010: Chemical Analysis A (3 credits) CHEM2011: Chemical Analysis Laboratory 1 (2 credits) CHEM2210: Organic Chemistry A (3 credits) CHEM2211: Organic Chemistry Lab I (2 credits) CHEM2310: Physical Chemistry I (3 credits)	CHEM2110: Inorganic Chemistry A (3 credits) CHEM2111: Inorganic Chemistry Lab I (2 credits) CHEM2311: Physical Chemistry Lab I (2 credits)
From either Semester 1 or Semester 2 MGMT2005-Computer Applications (3 credits) MGMT2008-Organizational Behaviour (3 credits) MGMT2012-Introduction to Quantitative Methods (3 credits) MGMT2021-Business Law I (3 credits) MGMT2023-Financial Management I (3 credits) MGMT2026-Introduction to Production & Operations Management (3 credits) MGMT2003-Principles of Marketing (3 credits)	
Level III: 18 compulsory credits	
9 credits of Chemistry taken from:	
CHEM3110: Inorganic Chemistry B (3 credits)	CHEM3310: Physical Chemistry II (3 credits) CHEM3010: Chemical Analysis B (3 credits) CHEM3210: Organic Chemistry B (3 credits)

Semester I	Semester II
Plus 9 credits of Management Studies courses:	
	MGMT3031:Business Strategy & Policy (3 credits)
From either Semester 1 or Semester 2 MGMT3031:Business Strategy & Policy (3 credits) MGMT3136: New Venture Creation & Entrepreneurship (3 credits)	
Plus 3 additional Level II/III credits from Chemistry and 3 additional Level II/Level III credits from a Management Studies course	

List of Chemistry electives

Course code	Course title	# of credits
CHEM2410	Water Treatment	4
CHEM2510	Food Processing Principles I	3
CHEM2511	Food Processing Laboratory	3
CHEM2512	Food Processing Principles II	3
CHEM3112	The Inorganic Chemistry of Biological Systems	3
CHEM3212	Natural Products Chemistry	3
CHEM3213	Applications of Organic Chemistry in Medicine & Agriculture	3
CHEM3312	Chemistry of Materials	3
CHEM3313	Topics In Advanced Physical Chemistry	3
CHEM3402	Chemistry in Industry	4
CHEM3510	Food Chemistry I	3
CHEM3512	Food Chemistry II	3
CHEM3610	Marine & Freshwater Chemistry	3
CHEM3711	Chemistry Undergraduate Research Project	6
CHEM3111	Inorganic Chemistry Lab II	2
CHEM3211	Organic Chemistry Lab II	2
CHEM3311	Physical Chemistry Lab II	2
CHEM3621	Marine & Freshwater Chemistry Field Course	2

NOTE:

1. Students entering after 2010/2011 and who have passed CAPE Accounting Units I & II with Grade IV or better will receive credit exemptions from ACCT1003 and ACCT1005.
2. The B.Sc. Chemistry and Management requires SIX credits of Level I Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Mathematics courses include:
   MATH1185 – Calculus for Scientists and Engineers
   MATH1141 - Introduction to Linear Algebra & Analytical Geometry
   MATH1142 – Calculus I
   MATH1151 – Calculus II
   MATH1152 – Introduction to Formal Mathematics
   STAT1001 – Statistics for Scientists

   Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for Advanced Chemistry courses.

   Students require MATH1141, MATH1142, MATH1151 and MATH1152 if they wish to pursue advanced courses in Mathematics.

B.Sc. CHEMISTRY WITH EDUCATION

(FOR TRAINED AND PRE-TRAINED TEACHERS)

Programme Summary/Overview

The B.Sc. Chemistry with Education programme is delivered jointly with the School of Education and provides pre-trained and trained teachers with a broad and rigorous study of chemistry as well as the theory, procedures and practices of science pedagogy required for a career in teaching chemistry. Graduates of this programme will be equipped with the requisite knowledge and skills to teach in secondary schools, work in chemical industries, business organizations, or pursue research in chemistry and/or chemical education.

Programme Rationale

There is a demand for chemistry teachers who can employ constructive practices such as inquiry-based teaching, collaborative initiatives, cutting edge technologies, and other current educational strategies into chemistry instruction. Graduates of this program are equipped to meet this demand, and have the option of pursuing careers in industry, business, or graduate research in chemistry and/or chemical education.

Programme Aims

The B.Sc. Degree in Chemistry and Education aims to equip students with the necessary skills to be able to:

- Explain the properties and reactivity of chemicals, design syntheses of selected materials and plan and safely conduct experiments to demonstrate or illustrate concepts in Chemistry.
- Use appropriate analytical techniques to detect, quantify, isolate, purify, and characterize materials and to explain the theoretical and instrumental bases of these techniques.
- Effectively work alone or within teams to carry out chemical investigations, evaluate scientific data and communicate findings both orally and in writing, using appropriate technical language.
- Employ constructive practices such as inquiry-based teaching, collaborative initiatives, cutting edge technologies, and other current educational strategies into chemistry instruction
- Design innovative instructional materials and/or strategies and apply communication skills, initiative, creativity, problem-solving and use of information technology strategies to effectively teach chemistry at the secondary level.

Programme Structure and Content

Pre-Trained Teacher

Pre-trained teachers are introduced to a range of introductory courses in chemistry and education. The chemistry courses in year 1 provide the fundamental concepts of bonding, structure and reactivity in chemistry while those in education expose them to various theories related to teaching, learning and curriculum. At this stage, students begin to hone their skills in the art and science of teaching through strategies such as observation, modelling, reflection and micro teaching. In their second and third years, they expand on this knowledge base in chemistry content by completing the core Level II courses required for a major in General Chemistry, and general education courses on the philosophy, psychology and sociology of teaching and learning that serve to prepare them for the teaching of science at the secondary level. These include courses on current strategies for teaching, assessing, using technologies and conducting practical work in science that take into consideration the way students learn and the context of the teaching learning environment.

An important feature of this programme is the field work component carried out in local secondary schools that enables pre-trained teachers to get initial teaching experience by first working in pairs in their second year and then individually in their final year for 4 and 6 weeks respectively. For the field work components they are required to plan and deliver aspects of secondary schools' science curricula under the supervision of their UWI supervisors and the cooperating teachers in the schools assigned. Efforts are made to expose them to teaching at both lower and upper secondary levels in more than one type of secondary institution in the two years.

Trained teachers

Trained teachers take the same courses pursued by the pre-trained teachers in their second and third years but the focus is on professional development. As such, a strong emphasis is placed on reflective practice and on identifying areas of their teaching that need to be strengthened. The trained teachers get an opportunity to revisit teaching through their field work experience. Here they are required to use action research as a means of planning, implementing and evaluating specific interventions used to teach topics from the CSEC curriculum over a 6 weeks period in secondary schools.

The course requirements and structure are as tabulated below.

YEAR	SEM	COURSE OPTION	FULL TIME		
			Trained Teachers Double Option Science Diploma	**Pre-trained Teachers – CAPE / A' Levels to Qualify (90 Cr)**	**Trained Teachers Single Option Science Diploma**
1	1	Science Ed Specialization	EDSC2405 (3) EDSC3403 (3)		EDSC2405 (3)
		Core Education	**3 credits taken from:** EDEA2305; EDGC2010; EDSC3408; EDCU2013	EDTL1020 (3) EDPS1003 (3) EDCU2013 (3)	**3 credits taken from:** EDEA2305; EDGC2010 EDSC3408; EDCU2013
		Faculty of Science and Technology	*Level 1 MATH (3)* *CHEM1901 (6)*	*Level 1 MATH(3)* *CHEM1901 (6)*	*Prelim Math (6)* *CHEM0901 (6)*
	2	Science Ed Specialization	EDSC3411(3) OR EDSC3404 (3)	EDSC2407 (3)	
		Core Education	EDTK2025 (3)	EDTL1021 (3)	EDTK2025 (3)
		Faculty of Science and Technology	*Level 1 MATH(3)* CHEM1902 (6)	*Level 1 MATH(3)* *CHEM1902*	*CHEM0902* *Prelim Math (6)*
		University Foundation Course	FOUN1014 (3)	FOUN1014 (3)	FOUN1101, FOUN1301 or other Foundation
2	1	Science Education Specialization	EDSC3417 (3)	EDSC 2405 (3) EDSC3403 (3)	EDSC3403 (3) EDSC3417 (3)
		Core Education	EDTL3020 (3) EDTL3021 (3)	EDTK2025 (3)	EDTL3020 (3) EDTL3021 (3)
		Chemistry	CHEM2310 (3) CHEM2210 (3) CHEM2211 (2)	CHEM2310 (3) CHEM2210 (3) CHEM2211 (2)	CHEM1901 (6)
		University Foundation Course	FOUN1101, FOUN1301 or any other Foundation	FOUN1101, FOUN1301 or any other Foundation	FOUN1101, FOUN1301 or any other Foundation
	2	Science Ed specialization	EDSC3410 (3)	EDSC3410 (3)	EDSC3411 (3) **OR** EDSC3403 (3) EDSC3410 (3)
		Core Education	EDRS3019 (3)	EDTL2021 (3)	EDRS3019 (3)
		Chemistry	CHEM2110 (3) CHEM2111(2) CHEM2311(2) CHEM3210(3)	CHEM2110 (3) CHEM2111(2) CHEM2311(2) CHEM3210 (3)	CHEM1902(6) Level 1 MATH (6)
		University Foundation	FOUN1101 or FOUN1301 or any other that is available	FOUN1101 or FOUN1301 or any other that is available	FOUN1014 (3)

YEAR	SEM	COURSE OPTION	Trained Teachers Double Option Science Diploma	Pre-trained Teachers – CAPE / A' Levels to Qualify (90 Cr)	Trained Teachers Single Option Science Diploma
3	1	Science Ed Specialization		EDSC3417 (3)	
		Core Education		EDTL3017 (3) EDPS3003 (3)	
		Chemistry	CHEM2010(3) CHEM2011(2) CHEM3110(3) Plus an additional 3 credits from Level II or III	CHEM2010(3) CHEM2011(2) CHEM3110(3)	CHEM2010(3) CHEM2011(2) CHEM2210 (3) CHEM2211(2) CHEM2310 (3) Plus one more Level II (3 credits)
	2	Core Education		EDRS3019 (3)	
		Chemistry	3 credits from Level III taken from CHEM3010 (3) **OR** CHEM3310	3 credits from Level III taken from CHEM3010 (3) **OR** CHEM3310 (3) Plus an additional 3 credits from Level II or III	CHEM2110 (3) CHEM3010 (3) CHEM3210 (3) CHEM3310 (3) Plus an additional 3 credits from Level II or III
		University Foundation			

List of Chemistry electives

Course code	Course title	# of credits
CHEM2402	Chemistry in our Daily Lives	3
CHEM2410	Water Treatment	4
CHEM2510	Food Processing Principles I	3
CHEM2511	Food Processing Laboratory	3
CHEM2512	Food Processing Principles II	3
CHEM3112	The Inorganic Chemistry of Biological Systems	3
CHEM3212	Natural Products Chemistry	3
CHEM3213	Applications of Organic Chemistry in Medicine & Agriculture	3
CHEM3312	Chemistry of Materials	3
CHEM3313	Topics In Advanced Physical Chemistry	3
CHEM3402	The Chemical Industries	4
CHEM3510	Food Chemistry I	3
CHEM3512	Food Chemistry II	3
CHEM3610	Marine & Freshwater Chemistry	3
CHEM3612	Atmospheric Chemistry & Biogeochemical Cycles	6
CHEM3111	Inorganic Chemistry Lab II	2
CHEM3211	Organic Chemistry Lab II	2
CHEM3311	Physical Chemistry Lab II	2
CHEM3511	Food Chemistry Laboratory	2
CHEM3611	Environmental Chemistry Laboratory	2
CHEM3621	Marine and Freshwater Chemistry Field Course	2
CHEM3711	Chemistry Undergraduate Research Project	6

NOTE:

1. The B.Sc. Chemistry with Education requires SIX credits of Level I Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Mathematics courses include:
   MATH1185 – Calculus for Scientists and Engineers
   MATH1141 - Introduction to Linear Algebra & Analytical Geometry
   MATH1142 – Calculus I
   MATH1151 – Calculus II
   MATH1152 – Introduction to Formal Mathematics
   STAT1001 – Statistics for Scientists

   Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for Advanced Chemistry courses.

   Students require MATH1141, MATH1142, MATH1151 and MATH1152 if they wish to pursue advanced courses in Mathematics.

2. Trained Teachers with the New Double Option Science (since 2004) with Chemistry as one of their majors and who have a GPA of at least 2.9 may be granted exemption from Level I requirements.

3. Trained Teachers with Single Option Science are required to do Preliminary Chemistry.

4. All students must complete the Foundation courses required by the FST.

5. Please consult the Faculty of Humanities & Education regarding the selection of Education Courses.

B.Sc. SPECIAL DEGREE IN CHEMISTRY

Programme Summary/Overview:

The Special Chemistry degree is designed for students who plan to pursue graduate research in Chemistry. In addition to taking the 39 credits in Chemistry required for the major in General Chemistry, students take a further 15 credits in Chemistry which must include a 6-credit research project. The programme summary and learning outcomes for the General Chemistry major apply to this option however the Special Chemistry degree offers enhanced and extended studies in undergraduate chemistry and broadens and deepens students' knowledge base and practical skills.

Programme Rationale:

This undergraduate degree provides optimal preparation for graduate research in Chemistry. Students with good aptitude for Chemistry are often suited for the rigors of this elite programme. Many graduates of this programme make significant contributions to creating new knowledge in Chemistry and assume leadership roles in science for academia, the service sector and industry.

Programme Aims:

The B.Sc. Special in Chemistry aims to equip students with the necessary skills to be able to:

- Apply General and Analytical Chemistry principles to design, plan and safely conduct chemical investigations and measurements to solve theoretical and practical problems.
- Use appropriate analytical techniques to detect, quantify, isolate, purify, and characterize materials and to explain the theoretical and instrumental bases of these techniques.
- Work alone or within teams to carry out chemical investigations, accurately record experimental data, evaluate their quality and relevance and seek to interpret them based on available theory and prior knowledge.
- Effectively communicate research findings both orally and in writing, using appropriate technical language.
- Recognize the interrelatedness of chemistry and other scientific disciplines and apply knowledge of chemistry to the solution of complex or unfamiliar problems.
- Independently manipulate advanced technology and data and employ the methods of scientific inquiry in a research oriented environment.

Programme Structure and Content:

The Special Chemistry degree consists of 54 credits of advanced chemistry which build on the 12 credits of broad based Level I Chemistry and 6 credits of Level I Mathematics. The 40 compulsory Level II and Level III credits consist of core courses in analytical, inorganic, organic and physical chemistry (A, I, O and P) and include 8 credits in laboratory courses which span the four sub-disciplines, as well as a 6-credit project course. Students in this programme are also required to take 4 credits in Level III laboratory courses in Chemistry, 10 credits in Chemistry electives, and 6 credits from Level II/III courses in another science subject or in Mathematics.

The course requirements and structure are as tabulated below:

Semester I	Semester II
LEVEL I : 18 compulsory credits	
CHEM1901 – Introductory Chemistry A (6) MATH- 6 credits from any Level I Mathematics courses (taken in Semester I and/or Semester 2). CAPE Physics or equivalent is required.	CHEM1902 – Introductory Chemistry B (6) FOUN1014: Critical Reading and Writing in Science and Technology and Medical Science (3), (taken in Semester I or Semester 2)
The following 20 Level II credits	
CHEM2010 – Chemical Analysis A (3) CHEM2011 – Chemical Analysis Laboratory I (2) CHEM2210 – Organic Chemistry A (3) CHEM2211 – Organic Chemistry Laboratory I (2) CHEM2310 – Physical Chemistry A (3)	CHEM2110 – Inorganic Chemistry A (3) CHEM2111– Inorganic Chemistry Laboratory I (2) CHEM2311 – Physical Chemistry Laboratory I (2)
The following 20 Level III credits	
CHEM3110 – Inorganic Chemistry B (3) CHEM3711 – Chemistry Undergraduate Research Project (6)	CHEM3010– Chemical Analysis B (3) CHEM3011- Chemical Analysis Laboratory II (2) CHEM3210 – Organic Chemistry B (3) CHEM3310 – Physical Chemistry B (3)
and at least 4 Level III credits from	
CHEM3311 – Physical Chemistry Laboratory II (2) CHEM3111 – Inorganic Chemistry Laboratory II (2)	CHEM3211– Organic Chemistry Laboratory II (2)
and 10 additional Level II/III credits from listed Chemistry electives and 6 credits from Level II courses in another subject in science or in Mathematics	

List of Chemistry electives

Course code	Course title	# of credits
CHEM2410	Water Treatment	4
CHEM2510	Food Processing Principles I	3
CHEM2511	Food Processing Laboratory	3
CHEM2512	Food Processing Principles II	3
CHEM3112	The Inorganic Chemistry of Biological Systems	3
CHEM3212	Natural Products Chemistry	3
CHEM3213	Applications of Organic Chemistry in Medicine & Agriculture	3
CHEM3312	Chemistry of Materials	3
CHEM3313	Topics In Advanced Physical Chemistry	3
CHEM3402	Chemistry in Industry	4
CHEM3510	Food Chemistry I	3
CHEM3512	Food Chemistry II	3
CHEM3610	Marine & Freshwater Chemistry	3
CHEM3612	Atmospheric Chemistry & Biogeochemical Cycles	6
CHEM3611	Environmental Chemistry Laboratory	2
CHEM3111	Inorganic Chemistry Lab II	2
CHEM3211	Organic Chemistry Lab II	2
CHEM3311	Physical Chemistry Lab II	2

NOTE:

The B.Sc. Special Chemistry requires SIX credits of Level I Mathematics. Any two Level 1 Mathematics courses will be acceptable. The Level 1 Mathematics courses include:

MATH1185 – Calculus for Scientists and Engineers
MATH1141 - Introduction to Linear Algebra & Analytical Geometry
MATH1142 – Calculus I
MATH1151 – Calculus II
MATH1152 – Introduction to Formal Mathematics
STAT1001 – Statistics for Scientists

Students are required to successfully complete the SIX credits of Level 1 Mathematics prior to registering for Advanced Chemistry courses.

Students require MATH1141, MATH1142, MATH1151 and MATH1152 if they wish to pursue advanced courses in Mathematics.

COURSE DESCRIPTIONS

PRELIMINARY CHEMISTRY COURSES

CHEM0901 **PRELIMINARY CHEMISTRY A**
(6 P-Credits) Semester 1 Level 0

Pre-requisite: CSEC (CXC) Chemistry Grade III or better or approved equivalents.

Course Content: This course covers the following topics:

- Introduction to Chemistry: Atomic theory of matter. Electronic configuration of the elements. The Periodic Table and related studies. The mole concept and stoichiometry. Chemical Bonding and molecular geometry.
- The characteristics and properties of matter: Properties of solutions. Chemical Energetics, the First Law of Thermodynamics; Enthalpy and its calculation.
- The chemistry of aliphatic hydrocarbons.
- *A practical course of 72 hours.*

Evaluation:

- Two 2-hour written papers 70%
- Course work 15%
- Practical work 15%

Practical work is assessed throughout the duration of the course. Students whose practical work is considered to be unsatisfactory are required to sit a practical examination of not more than six hours. Candidates must provide the ORIGINAL worksheets of their laboratory work at the practical examination. These must be certified by the laboratory course Supervisor and may be taken into consideration by the Examiners.

CHEM0902 **PRELIMINARY CHEMISTRY B**

(6 P-Credits) Semester 2 Level 0

Pre-requisite: CSEC (CXC) Chemistry Grade III or better or approved equivalents.

Course Content: This course covers the following topics:

- Properties and Reactivity of Main Group Elements and their compounds. Transition Elements and their compounds. Coordination compounds.
- Kinetics, Rates of chemical reactions. Principles of Electrochemistry. Chemical Equilibrium and its application.
- A functional group approach to the chemistry of organic compounds: alkyl halides, alcohols, carbonyl compounds, carboxylic acids and their derivatives and amines.
- *A practical course of 72 hours.*

Evaluation:

- Two 2-hour written papers 70%
- Course work 15%
- Practical work 15%

Practical work is assessed throughout the duration of the course. Students whose practical work is considered to be unsatisfactory are required to sit a practical examination of not more than six hours. Candidates must provide the ORIGINAL worksheets of their laboratory work at the practical examination. These must be certified by the laboratory course Supervisor and may be taken into consideration by the Examiners.

LEVEL I COURSES

CHEM1901 **INTRODUCTORY CHEMISTRY A**
(6 Credits) Semester 1 Level I

Pre-requisites: CHEM0901 and CHEM0902, CAPE Chemistry or GCE A-level Chemistry Units 1 **and** 2 or approved equivalents.

Course Content: This course covers the following topics:

- Introductory Analytical Chemistry: Theory of neutralization titrations, titration curves, spectrophotometry.
- Atomic Theory: Interactions between atoms, ions and molecules. Crystal structures and symmetry elements. Born-Haber cycle. Molecular Orbital Theory for homo- and hetero-nuclear diatomic molecules.
- Energetics and Molecular Structure: heat capacity variation with temperature, wave behaviour in molecules, Boltzmann distribution, origin of molecular spectra.
- A mechanistic approach to the chemistry of alkanes, alkenes and alkynes. An introduction to the stereochemistry of organic molecules.
- *A practical course of 72 hours.*

Evaluation:

- Two 2-hour written papers 75%
- In-course test 10%
- Practical work 15%

Practical work is assessed throughout the duration of the course. Students whose practical work is considered to be unsatisfactory are required to sit a practical examination of not more than six hours. Candidates must provide the ORIGINAL worksheets of their laboratory work at the practical examination. These must be certified by the laboratory course Supervisor and may be taken into consideration by the Examiners.

CHEM1902 **INTRODUCTORY CHEMISTRY B**

(6 Credits) Semester 2 Level I

Pre-requisites: CHEM0901 and CHEM0902, CAPE Chemistry or GCE A-level Chemistry Units 1 **and** 2 or approved equivalents.

Course Content: This course covers the following topics:

- A detailed study of Main Group elements based on their position in the Periodic Table. The properties of oxygen and its compounds. Coordination compounds of First Row Transition Elements and their stereochemical features. Introduction to Crystal Field Theory. Stability of metal complexes. Isomerism.
- Thermodynamics: Introduction to meaning and uses of Internal Energy, Enthalpy, Entropy and Gibbs Energy to ideal gas processes and chemical reactions. Electrochemistry of cells, Nernst Equation. Kinetics; order, molecularity and rate equations. Enthalpy and Entropy of activation.
- Synthesis and Reactions of functionalised organic compounds. Introduction to Aromatic Chemistry.
- *A practical course of 72 hours.*

Evaluation:

- Two 2-hour written papers 75%
- In-course test 10%
- Practical Work 15%

Practical work is assessed throughout the duration of the course. Students whose practical work is considered to be unsatisfactory are required to sit a practical examination of not more than six hours. Candidates must provide the ORIGINAL worksheets of their laboratory work at the practical examination. These must be certified by the laboratory course Supervisor and may be taken into consideration by the Examiners.

Both CHEM1901 and CHEM1902 must be successfully completed before students can proceed to Level 2 courses in Chemistry.

LEVEL II COURSES

CHEM2010 **CHEMICAL ANALYSIS A**
(3Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902, FOUN1014/ FOUN1019 and Permission of HOD

Course Content: This course covers the following topics:

- The analytical process and approaches to management of analytical laboratories: identifying and quantifying errors, statistical tests.
- Introduction to analytical electrochemistry: redox titrations, electrochemical cells and electrode potentials, the Nernst equation, pH and ion-selective electrodes.
- Introduction to chromatography: basic principles and types e.g. planar and column chromatography including high performance liquid chromatography and gas chromatography. Factors affecting separations Instrumental components and sample requirements, techniques for qualitative and quantitative chromatographic analysis.
- Introduction to analytical molecular absorption spectroscopy: Beer-Lambert's law, instrumentation and applications.

Evaluation:

- One 2-hour written examination 60%
- In-course tests 20%
- Course assignment 20%

CHEM2011 **CHEMICAL ANALYSIS LABORATORY I**

(2 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902, FOUN1014/FOUN1019 and Permission of HOD

Co-requisite: CHEM2010

Course Content: This course covers the following topics:

- Laboratory experiments designed around some Fundamental conventional and instrumental analytical procedures such as but not limited to redox titrations, spectrophotometric analyses, analyses with electrodes and chromatographic separations.
- Workshops on effective approaches to scientific and technical writing.

Evaluation:

- Laboratory reports 50%
- Laboratory skills 25%
- Writing exercises 25%

CHEM2110 **INORGANIC CHEMISTRY A**

(3 Credits) Semester 2 Level II

Pre-requisites: CHEM1901 and CHEM1902

Course Content: This course covers the following topics:

- Structure and Bonding: Review of Crystal Field Theory. Ligand Field Theory. Spectroscopic and Magnetic properties of complexes.
- Chemistry of transition metals.
- Mechanisms of inorganic reactions: Substitution and electron transfer reactions.
- Transition metal organometallics: metal carbonyls, metal alkyls, cyclopentadienyl and arene complexes.
- Catalysis.

Evaluation:

- One 2-hour written paper 60%
- In-course test 40%
-

CHEM2111 **INORGANIC CHEMISTRY LABORATORY I**
(2 Credits) Semester 2 Level 2

Pre-requisites: CHEM1901 and CHEM1902

Co-requisite: CHEM2110

Course Content: This lecture/laboratory-based course is designed to develop skills in inorganic chemistry, including synthetic reaction procedures, isolation, and employment of spectroscopic techniques for the identification of compounds. It provides students with hands on training necessary to develop skills in: problem-solving, manipulation of equipment, critical thinking, data collection, processing and analysis, synthesis, experimental design, team work, time management, oral and written communication. In addition it exposes students to international laboratory safety standards. The lectures will cover aspects of UV/Vis spectroscopy of transition metal complexes as well as their magnetic properties.

Evaluation:

- Laboratory reports 80%
- In-course test 20%
-

CHEM2210 **ORGANIC CHEMISTRY A**
(3 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902

Course Content: This course covers the following topics:

- The application of spectroscopic techniques in organic chemistry: electronic, infrared, proton and carbon-13 magnetic resonance spectroscopy, mass spectrometry. Their utility in elucidating the structure of organic compounds.
- Carbocyclic and heterocyclic aromatic compounds. Review of the concept of aromaticity. Electrophilic and nucleophilic

substitution in benzenoid systems. Polycyclic aromatic compounds: naphthalene, anthracene and phenanthrene. Selected reactions of simple heterocycles.

- Overview of the main types of organic reactions: substitution, addition, elimination, cyclization. Reaction mechanisms and methods of determining them. Generation, structure and fate of reactive intermediates (carbocations and carbanions). The role of carbanions in carbon-carbon bond formation: reactions of enolate ions and organometallic compounds. Diels Alder reactions.

Evaluation:

- One 2-hour written examination 60%
- Two In-course tests 40%

CHEM2211 **ORGANIC CHEMISTRY LABORATORY I**

(2 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902

Co-requisite: CHEM2210

Course Content: This course covers the following topics:

- Isolation of natural products; synthetic techniques (including chemoselectivity, aldol reactions, electrophilic aromatic substitution, aromatic diazonium chemistry, heterocyclic synthesis, molecular rearrangement); organic stereochemistry; principles of green chemistry; characterisation of unknown organic compounds; thin layer chromatographic analysis.

Evaluation:

- Laboratory reports 80%
- In-course test 20%

CHEM2310 **PHYSICAL CHEMISTRY A**

(3 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902

Course Content: This course covers the following topics:

- First and Second Laws of thermodynamics applied to phase equilibria of a pure substance, homogeneous and heterogeneous mixtures and chemical equilibria. Free energy and chemical potentials. Phase Rule. Chemical equilibrium. Liquid/vapour phase diagrams for binary mixtures. Dilute solutions. Colligative effects. Electrolyte solutions: Debye-Hückel theory.

- Thermodynamics of galvanic cells. Nernst equation. Potentiometric determination of thermodynamic properties of redox processes. Equilibrium constants, potentiometric titration, disproportionation. Liquid junctions. Membrane potentials. Ion-selective electrodes. Theory of ionic transport in aqueous solutions and its applications.

- Elementary reactions. Rate equations. Multi-step mechanisms. Steady-state and equilibrium approximations. Chemical oscillators. Flow methods and relaxation methods. Activated-complex theory and the Eyring equation. Primary kinetic salt effect. Photochemical processes.

Evaluation:

- One 2-hour written examination 60%
- In-course tests 40%

CHEM2311 **PHYSICAL CHEMISTRY LABORATORY I**

(2 Credits) Semester 2 Level II

Pre-requisites: CHEM1901 and CHEM1902

Co-requisite: CHEM2310

Course Content: This course covers the following topics:

- This laboratory course is designed to develop laboratory skills in physical chemistry, including proper use of instruments, data collection and analysis, estimation of errors and scientific report writing. Specific areas to be focused on include: Chemical thermodynamics, Electrochemistry, Quantum mechanics, Atomic spectroscopy, Molecular spectroscopy and Chemical kinetics.

Evaluation:

- Laboratory reports 80%
- One In-course test 20%

CHEM2402 **CHEMISTRY IN OUR DAILY LIVES**

(3 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902 & Permission of HOD

Course Content: This course covers the following topics:

- The role of chemistry in producing consumer products. Chemistry of textiles and, clothing, sport and crime. Applications of chemistry to the arts, crime-fighting and law enforcement, economics and politics. Chemistry and the environment.

Evaluation:

- One 2-hour written examination 50%
- In-course test 20%
- Graded assignments/presentations 30%

CHEM2402 is open to FST students at the Advanced level who have successfully completed Level 1 (CHEM1901 and CHEM1902) Chemistry courses. It ***is available as an elective*** *to students doing the Bachelors*

*programme in Education with Chemistry, B.Sc. Chemistry with Education degree and the OESH programme. This course **CANNOT** be counted towards a major or minor in Chemistry.*

CHEM2410 **WATER TREATMENT**

(4 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902 and Permission of HOD

Course Content: This course covers the following topics:

- Water for industrial, agricultural, and domestic purposes: distribution, quality, environmental contamination. Water re-use and recycling.
- Water quality standards: regulations for industrial effluents, potable water, sewage effluents and their receiving bodies (river, wells and coastal waters). Water quality monitoring.
- Treatment and disposal of Wastewater, Domestic Sewage and Industrial Wastes. Characterization of potable, raw, waste and receiving waters.
- *A practical course of 48 hours.*

Evaluation:

- One 2-hour written examination 50%
- In-course tests 10%
- Course assignments 10%
- Laboratory Work 20%
- Field Trip Reports 10%

CHEM2510 **FOOD PROCESSING PRINCIPLES I**

(3 Credits) Semester 2 Level II

Pre-requisites: CHEM1901 and CHEM1902 and Permission of HOD. *Preference will be given to students majoring in Food Chemistry.*

Course Content: This course covers the following topics:

- Basic principles, technologies and applications involved in the processing of foods.
- Processing at ambient temperatures: Characteristics of raw food, material transfer and fluid flow, heat transfer, spoilage and deterioration mechanisms, food preservation, effect of processing on sensory and nutritional properties, microbial risks and food safety issues.
- Raw material preparation: size reduction, mixing and forming, separation, fermentation and enzyme technology, pickling and curing.
- Processing by removal of heat: Refrigeration, chilling and refrigerated storage, freezing, freeze drying and concentration.
- Modified atmosphere storage and packaging, material handling, storage and distribution.

Evaluation:

- One 2-hour written examination 60%
- In-course tests 20%
- Course assignments 20%

CHEM2511 **FOOD PROCESSING LABORATORY**

(3 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902 and Permission of HOD. *Preference will be given to students majoring in Food Chemistry.*

Co-requisites: CHEM2512

Course Content: This course covers the following topics:

- Practical exposure to the skills required to function effectively in a food manufacturing facility.
- Handling, preparation, processing, and packaging of selected food products. Food processing operations involving ambient, thermal and non-thermal unit operations will be carried out and/or observed.
- Laboratory activities will be carried out in teams, and reports will be individually produced.

Evaluation:

- Laboratory and field trip reports 75%
- Research paper assignment 15%
- Oral presentation 10%

CHEM2512 **FOOD PROCESSING PRINCIPLES II**
(3 Credits) Semester 1 Level II

Pre-requisites: CHEM1901 and CHEM1902. Permission of HOD. *Preference will be given to students majoring in Food Chemistry.*

Course Content: This course covers the following topics:

- Thermal processing (steam, hot air and oil) and packaging operations: blanching; pasteurization. Heat sterilization: retorting; ultra-high temperature (UHT) and aseptic processes.
- Evaporation and Distillation: boiling point elevation types of evaporators, selection of evaporators, vapour compression, simple distillation systems, continuous and batch systems.
- Hot Air Psychrometrics. Properties of dry air, properties of water vapour, air-vapour mixtures, dew-point, humidity ratio, relative

humidity, wet bulb temperature, psychrometric chart.

- Dehydration: drying process, moisture diffusion, drying rate curves, drying time predictions, mass and energy balances, drying systems.
- Other processing methods: frying, irradiation, electric fields and high pressure, packaging operations and principles.

Evaluation:

- One 2-hour written examination 60%
- In-course tests 20%
- Course assignments 20%

LEVEL III CHEMISTRY COURSES

CHEM3010 **CHEMICAL ANALYSIS B**
(3 Credits) Semester 2 Level III

Pre-requisite: CHEM2010

Course Content: This course covers the following topics:

- The process approach to quality management; the collection and analysis of real samples; Quantifying and reporting data quality.
- Advanced Chromatography principles; Gas and high performance liquid chromatographies; Tandem techniques (GC-MS, HPLC-MS); Developing chromatographic techniques.
- Analytical Atomic Spectrometry: Atomic Emission Spectrometry: the Boltzmann equation, instrumental components, applications. Flame and Electrothermal Atomic Absorption Spectrometries; X-ray Fluorescence, Instrumental Neutron Activation Analysis and Inductively Coupled Plasma Spectrometries: theories, instruments, advantages and disadvantages.

Evaluation:

- One 2-hour written examination 60%
- In-course tests 20%
- Course assignment 20%

CHEM3011 **CHEMICAL ANALYSIS LABORATORY II**
(2 Credits) Semester 2 Level III

Pre-requisites: CHEM2010 and CHEM2011 (*Pass or Fail but not Fail Absent)*

Co-requisite: CHEM3010

Course Content: This course covers the following topics:

- A laboratory-based project centred on the application of one or two instrumental

analytical techniques to the analysis of a real sample: hypotheses, project planning, sampling, sample preparation, instrumental analyses, Evaluation of data quality, interpretation, report preparation. Students work in groups of two or three.

- A series of workshops on effective oral communication skills;
- An oral presentation of the laboratory project.

Evaluation:

- Laboratory reports 50%
- Laboratory skills 25%
- Speaking exercises 25%

CHEM3110 **INORGANIC CHEMISTRY B**

(3 Credits) Semester 1 Level III

Pre-requisites: CHEM2110

Course Content: This course covers the following topics:

- Structure and Bonding. Introduction to Group Theory. Symmetry elements and operations. Point groups. Construction of character tables. Application of Group Theory to Bonding. Energy level of diagrams for octahedral transition metal complexes.
- Main Group elements: Hydrogen and its compounds, Oxides and oxyacids. Halogens and halides. Main Group organometallic compounds.

Evaluation:

- One 2-hour written examination 60%
- In-course test 40%

CHEM3111 INORGANIC CHEMISTRY LABORATORY II

(2 Credits) Semester 1 Level III

Pre-requisite: CHEM2111

Co-requisite: CHEM3312 and/or CHEM3112

Course Content: Laboratory experiments will cover advanced techniques in Inorganic Chemistry and may include the following topics:

- Experimental techniques used in the synthesis and characterization of inorganic compounds (X-ray diffraction, NMR, and electronic spectroscopy, etc.)
- Synthesis of super conductors
- Synthesis of organometallic compounds and their use as catalysts
- Synthesis of transition metal complexes and their use as mimics of enzymes.
- Quadruple M-M bonds: Preparation of chromium (II) acetate dimer.

Evaluation:

- Written laboratory reports 80%
- One one-hour course tests 20%

CHEM3112 THE INORGANIC CHEMISTRY OF BIOLOGICAL SYSTEMS

(3 Credits) Semester 1 Level III

Pre-requisites: CHEM2110 and CHEM3110.

Course Content: This course covers the following topics:

- Amino acids, peptides and proteins;
- Metal storage & transport: Fe, Cu, Zn and V;
- Molecular dioxygen, O_2;
- Biological redox processes;
- The Zn^{2+} ion: Nature's Lewis acid;
- Metal complexes used for diagnosis and treatment in medicine.

Evaluation:

- One 2-hour written final examination 60%
- Two 1-hour in-course tests 30%
- One course assignment 10%

CHEM3210 **ORGANIC CHEMISTRY B**

(3 Credits) Semester 2 Level III

Pre-requisite: CHEM2210 *Pass or Fail but NOT Fail Absent*

Course Content: This course covers the following topics:

- Target oriented organic synthesis. An introduction to retrosynthetic analysis. Reagents and methods for effecting carbon-carbon single and double bond formation, oxidation, reduction and cyclization.
- Mechanisms of carbocation and related rearrangements, substitution and elimination reactions.
- Stereochemistry of organic molecules. Static and dynamic aspects.
- The chemistry of carbohydrates- the synthesis and properties of mono- and disaccharides. The chemistry of amino acids, peptides and proteins.

Evaluation:

- One 2-hour written examination 60%
- Two In-course tests 40%

CHEM3211 **ORGANIC CHEMISTRY LABORATORY II**

(2 Credits) Semester 2 Level III

Pre-requisites: CHEM2211 AND permission of HOD

Co-requisite(s): CHEM3212 and/or CHEM3213

Course Content: This course covers the following topics:

- Synthesis of selected herbicides, insecticides, antibiotics and anticonvulsants; reactions of carbohydrates, lipids, terpenoids and steroids; column chromatographic purification; spectroscopic analysis.

Evaluation:

- Laboratory reports 80%
- In-course test(s) 20%

CHEM3212 **NATURAL PRODUCTS CHEMISTRY**

(3 Credits) Semester 2 Level III

Pre-requisites: CHEM2210 and CHEM3210 AND permission of HOD

Course Content: This course covers the following topics:

- Biosynthesis of Natural Products;
- Structural diversity in Natural Products Chemistry;
- Methods used in the elucidation of biosynthetic pathways.
- Advanced Spectroscopy: Mass spectrometry; instrumentation, isotope abundances and HRMS; Uses of MS other than for structure elucidation;
- Carbon-13 nuclear magnetic resonance spectroscopy; Instrumentation; Spectral interpretation; Uses of C-13 NMR other than for structure determination.
- The Synthesis and Chemistry of Natural Products; Linear versus convergent syntheses; Retrosynthetic analysis.
- Study of selected syntheses and synthetic transformations of natural products – terpenoids, alkaloids, phenolics.

Evaluation:

- One 2-hour written examination 60%
- Two in-course tests 40%

CHEM3213 **APPLICATIONS OF ORGANIC CHEMISTRY IN MEDICINE AND AGRICULTURE**

(3 Credits) Semester 1 Level III

Pre-requisites: CHEM2210 and CHEM3210 or CHEM2201 and CHEM3201*from the old curriculum*

Course Content: This course covers the following topics:

Organic Chemistry in Medicine:

- Drug classification, the concept of receptor sites; an introduction to quantitative aspects of drug receptor interactions.
- Drug Administration, distribution and metabolism; anti-infective agents; anti-allergenic and anti-ulcerative agents; central nervous system depressants; analgesics.

Organic Chemistry in Agriculture

- Use of organic compounds for the control of pests.
- Stages in the research and development of pesticides.
- An examination of insecticides, herbicides and fungicides with respect to structure, mode, of action, metabolism, synthesis, and environmental impact.

Evaluation:

- One 2-hour written examination 60%
- Two in-course tests 40%

CHEM3310 **PHYSICAL CHEMISTRY B**

(3 Credits) Semester 2 Level III

Pre-requisite: CHEM2310 *Pass or Fail but NOT Fail Absent*

Course Content: This course covers the following topics:

- Quantum mechanics; The Schrödinger wave equation. Simple harmonic motion. Rotation: Orbital and spin angular momentum. Vibrational and rotational spectra of diatomic molecules.
- Microstates of matter; Boltzmann entropy formula; Connection between molecular properties and macroscopic behaviour; Applications to ideal gases. Maxwell-Boltzmann distribution; Configurational partition functions of non-ideal fluids. Structural phase transitions.
- Electronic spectra of atoms; Electronic spectra of molecules. Selection rules.

Nuclear Magnetic Resonance (NMR). Electrons and nuclei in magnetic fields. Proton-NMR spectra.

Evaluation:

- One 2-hour written examination 60%
- Two In-course tests 30%
- One written assignment 10%

CHEM3311 **PHYSICAL CHEMISTRY LABORATORY II**

(2 Credits) Semester 1 Level III

Pre-requisites: CHEM2311 and permission of HOD

Co-requisite(s): CHEM3312 and/or CHEM3313 *(effective 2013/14)*

Course Content: This course covers the following topics:

- polymer viscosity
- surface chemistry micellization
- X-ray diffraction
- polymer synthesis and characterization magnetic properties of solutions.

Evaluation:

- Laboratory reports 80%
- In-course test(s) 20%

CHEM3312 **CHEMISTRY OF MATERIALS**

(3 Credits) Semester 1 Level III

Pre-requisites: CHEM2310 and CHEM2110 AND permission of HOD

Course Content: This course covers the following topics:

- Polymers: definitions, nomenclature, molecular architecture.
- Colloids and Surfaces: liquid – gas and liquid–liquid interfaces, surface and interfacial tensions; Capillary action;

Micelle formation; Adsorption isotherms; composition and structure of solid surfaces.

- The Structure of Solids: Symmetry in crystals and their diffraction patterns. X-ray Diffraction: the Powder Method versus Single Crystal X-ray Diffraction.
- Semiconductors: properties and types; optical and electrical properties, photoconductivity, luminescence; Applications.
- Classification of nanomaterials: Synthesis; structure and properties.
- Materials Characterisation; Optical and Electron Microscopy: TEM, SEM; Surface and Bulk Characterisation Techniques.

Evaluation:

- One 2-hour written final examination: 60%
- Two in-course tests (10% each): 20%
- One assignment 20%

CHEM3313 **TOPICS IN ADVANCED PHYSICAL CHEMISTRY**

(3 Credits) Semester 2 Level III

Pre-requisites: CHEM2310 and CHEM3310

Course Content: This course covers the following topics:

- Computational Methods: Molecular orbital approximations; Molecular conformational energies; Charge distributions; Dipole moments.
- Molecular Interactions: Electric dipole moments; Interaction between dipoles; Hydrogen bonding; Molecular recognition; Kinetic model for the perfect gas; Real gases; Molecular Interactions in liquids.
- Redox Processes and Advanced Electrochemistry: Electron transfer; Marcus theory for electron transfer; Electrified

interfaces; Diffusion and migration. Cell design; Liquid junctions; Butler-Volmer equation and Tafel plots; Polarography; Cyclic voltammetry and impedance methods.

Evaluation:

- One 2-hour written examination 60%
- Two in-course tests 30%
- One assignment 10%

CHEM3401 **PROJECT EVALUATION AND MANAGEMENT FOR SCIENCE BASED INDUSTRIES**

(4 Credits) Semester 1 Level III

This course is only available to students majoring in Applied Chemistry and Food Chemistry but students who do not have any overlapping Management Studies courses and are majoring in areas which have an industrial direction and have the approval of the Department within which they are majoring may be allowed to take this course.

Pre-requisites: CHEM2510 + CHEM2511 or CHEM3402 AND permission of HOD

Course Content: This course covers the following topics:

- **Economics***:* Introduction to macro & micro-economics; Supply and demand, pricing policy, price elasticity, profit vs. revenue maximising decisions; production function, maturity of industry.
- **Accounting***:* Cost, volume and profit analysis; allocation of resources; preparation, analysis and reporting on management accounts.
- **Project Evaluation and Management***:* The project concept, project development and appraisals, discounting, risk analysis, project implementation and time management, critical path method.
- **Team Building Workshops:** Teamwork, interpersonal skills, leadership, decision

making, communication and conflict management.

Evaluation:

- One 2-hour written examination 75%
- Team-based project 25%

CHEM3402 **THE CHEMICAL INDUSTRIES**

(4 Credits) Semester 2 Level II

Pre- requisites: Any two of CHEM2010 + CHEM2011, CHEM2110 + CHEM2111, CHEM2210 + CHEM2211 or CHEM2310 and Permission of HOD

Course Content: This course will cover at least TWO of the following topics extensively:

- **Bauxite/Alumina**. Bauxites: types and origins, mineralogy and process design. Bauxite Processing by the Bayer process: Mining, desilication, digestion, the mud circuit, precipitation, calcination. Material flow diagrams, analytical techniques, product quality and uses, waste disposal and environmental impacts.
- **Petroleum and Petrochemical**: Crude oil and natural gas: formation, extraction, characterization, transportation and storage. Petroleum Refining; Analytical monitoring and quality control; Environmental impacts; Regulations and monitoring.
- **Sugar Cane Processing**: Global and local industries; raw materials and their quality; cane preparation and milling; Clarification: reactions, equipment and effects of impurities; Evaporation; Crystallization. Product quality; By-products. Environmental regulations and waste management.
- **Cement Manufacture**: Technologies, raw materials and products; Basic cement chemistry; Equipment; Measurement and

control of fineness. CaO-SiO_2-Al_2O_3 ternary system; chemical, physical and mineralogical transformations; clinker quality, grinding and cement preparation; Energy re-use and environmental regulations.

Students are required to work for at least 8 weeks in an approved industrial setting during the summer following the theory component of the course.

Evaluation:

- One 2-hour written examination 50%
- Course assignment 25%
- Work placement 25%

CHEM3403 **CHEMICAL PROCESS PRINCIPLES**

(8 Credits) Semester 2 Level III

Pre-requisites: CHEM2310 and CHEM2311 and Permission of HOD

Course Content: This course covers the following topics:

- Process Material Balances.
- Heat Transfer Operations
- Mass Transfer Processes
- Applied Thermodynamics and
- Applied Kinetics.

- *Course requires 72 hours of laboratory work.*

Evaluation:

- Two 2-hour written examinations 60%
- In-course test 15%
- Practical work 25%

Practical work is assessed throughout the duration of the courses. Students whose practical work is considered to be unsatisfactory are required to sit a practical examination of not more than six (6) hours. Candidates must provide the ORIGINAL notebooks and reports of their laboratory work at the practical examination. These must be certified by the laboratory course supervisor and may be taken into consideration by the examiners.

CHEM3510 **FOOD CHEMISTRY I**

(3 Credits) Semester 1 Level III

Pre-requisites: CHEM2010 & CHEM2011 and CHEM2210 & CHEM2211 and permission of HOD

Course Content: This course covers the following topics:

- **Water:** properties; water-solute interactions, ice-water interactions; water activity and food stability.
- **Carbohydrates:** structure and classification; starch, pectin, cellulose, gums and dietary fiber; effect of carbohydrates on properties of food; chemical reactions of carbohydrates in foods.
- **Proteins**: amino acid - structure and properties; proteins - structure and properties; interactions with other food components; effects of processing on protein structure, function and quality.
- **Lipids**: structure and classification; relationship between lipids and health; lipid degradation; hydrolysis and autoxidation; application of antioxidants; processing of lipids. Effects of processing on properties of food.

Evaluation:

- One 2-hour written examination 60%
- In-course test(s) 20%
- Course assignment 20%

CHEM3511 **FOOD CHEMISTRY LABORATORY**

(3 Credits) Semester 2 Level III

Pre-requisite: Permission of HOD

Co-requisites: CHEM3510, CHEM3512

Course Content: This course covers the following topics:

- Analytical techniques and methodologies commonly used for the analysis of macro and micro food components including: spectrophotometry, polarimetry, titrimetry and high performance liquid chromatography. Experiments will involve sample preparation, instrumental analyses, data analysis, and report preparation. Practical food analysis will be carried out in teams, and reports will be individually produced. Three lecture sessions will address topics including research ethics, research methodology, laboratory safety, and good laboratory practices.

Evaluation:

- Laboratory reports 50%
- Laboratory skills 30%
- Course assignment 10%
- Oral presentation 10%

CHEM3512 **FOOD CHEMISTRY II**

(3 Credits) Semester 2 Level III

Pre-requisites: CHEM2010 + CHEM2011 and CHEM2210 + CHEM2211 and Permission of HOD

Course Content: This course covers the following topics:

- **Enzymes**: nomenclature; catalysis; deactivation; applications in food processing; enzymes and health.
- **Vitamins and Minerals**: water and fat soluble vitamins; bulk and trace minerals; sources, functions and role in health; bioavailability, effects of processing; vitamin and mineral supplementation of foods; toxicity.
- **Pigments and Flavours**: natural and artificial colourants, dyes and lakes; flavours and flavourings; chemistry and

physiology of taste and saporous substances; flavour enhancement.

- **Food Additives**: classes and applications; safety considerations.
- **Toxicants and Allergens**: sources, properties and chemistry; effects on consumer; effect of processing; measures for elimination or reduction of levels in foods.

Evaluation:

- One 2-hour written examination 60%
- In-course test 20%
- Course assignment 20%

CHEM3513 **FOOD SAFETY & QUALITY ASSURANCE**

(3 Credits) Semester 2 Level III

Pre-requisites: CHEM2510 **OR** CHEM2512 and Permission of HOD. *Preference will be given to students majoring in Food Chemistry.*

Course Content: This course covers the following topics:

- Quality Assurance and Quality Control: Food laws and regulations; Codex Alimentarius; food standards; food quality and food safety.
- Quality Systems: Total Quality Management; ISO9000; HACCP; Quality by Design (QbD).
- Prerequisite Programmes for Food Safety: Good Manufacturing Practices; Sanitation; Facilities & equipment; Personnel training; Traceability & recall; Transport & receiving; Chemical control; Production & Process control.

Evaluation:

- One 2-hour written examination 60%
- One 1-hour in-course test 20%
- One written assignment 20%

CHEM3610 **MARINE AND FRESHWATER CHEMISTRY**

(3 credits) Semester 1 Level III

Pre-requisites: CHEM2010, CHEM2011 and any one of the following: CHEM2110, CHEM2210, CHEM2310: or CHEM3010. Preference will be given to students pursuing a major in Environmental Chemistry.

Course content: This course covers the following topics:

- Introduction to the Evolution, Structure & Composition of Planet Earth; Water and Rock cycles; Biogeochemical cycles; Characteristics of water bodies.
- Acidity and metals: Acid-base properties of water bodies; the $CO_3^{2-}/HCO_3^-/CO_2$ (aq) system; Inorganic C speciation; Henry's law and its applications; pH of rain water; photosynthesis and ocean acidification.
- Redox equilibria; redox speciation diagrams.
- Nutrients and Organics: Natural and anthropogenic sources; Adsorption–desorption processes; eutrophication; humic and fulvic acids; Persistent organic pollutants; emerging organic pollutants.
- Sampling and analytical methods.

Evaluation:

- One 2-hour written examination 60%
- Three 30-minute course tests 20%
- Three course assignments 20%

CHEM3611 ENVIRONMENTAL CHEMISTRY LABORATORY

(2 Credits) Semester 1 Level III

Co-requisite: CHEM3610 and Permission of HOD. *Preference will be given to students majoring in Environmental Chemistry.*

Course Content: This course covers the following:

- Interactive workshops on environmental sampling: sample preservation, conducting field observations and measurements, structuring of field reports.
- Guided review of the Hermitage Sewage Treatment plant and the UWI Water Re-use programme.
- Team-based collection of treated effluent samples from Lake Sidrak over a 4-week period and cycling through various analyses (to include P, N, pH/ANC and cations).
- Collection of soil samples exposed to irrigation with tertiary-treated effluent and, for comparison, agricultural soil and soil exposed only to rainfall.
- Team-based analyses of soils over a 4-week period (to include: CEC and pH, P, N, Na, K, Ca, Mg, trace metals and heavy metals (via XRF & INAA), mineralogy (XRD), particle size and colour).

Evaluation:

- Laboratory reports 60%
- Technical reports (two at 20% each) 40%

CHEM3612 **ATMOSPHERIC CHEMISTRY AND BIOGEOCHEMICAL CYCLES**

(6 credits) Semester 2 Level III

Pre-requisites: CHEM3610 and HOD permission. *Preference will be given to students majoring in Environmental Chemistry.*

This course covers the following:

Course Content: This course covers the following topics:

- Atmospheric Chemistry: Atmospheric composition and structure; Atmospheric pollution: Global warming; Acid rain; Photochemical smog; Ozone depletion and global treaties.
- Environmental models, management and regulations: Use of Models in Atmospheric Chemistry, Air pollution and management; Air quality standards and pollution monitoring pollution.
- Biogeochemical Cycles: Nutrient cycles: P, N, Si, C, O. Metal cycles: toxic and essential metals; fluxes, residence times, sources and industrial uses; sampling and analytical methods.
- Organic materials: Biomolecules, their structure, degradation and impacts; pesticides, herbicides, fungicides and emerging pollutants.

Evaluation:

- One 2-hour written examination 50%
- Two 45-minute course tests 20%
- Course project 15%
- Field trip reports 15%

CHEM3621 **MARINE AND FRESHWATER CHEMISTRY FIELD COURSE**

(2 credits) Semester 2 Level III

Pre-requisites: CHEM3610 and HOD permission. *Preference will be given to students majoring in Environmental Chemistry.*

Course Content: This course covers the following:

- An introductory workshop on the status of Jamaica's environment, objectives of the course and student responsibilities.
- A five-day encampment at the UWI Discovery Bay Marine Laboratory:
  - Observation of environmental conditions and biological activities within Discovery Bay.
  - Collection and analysis of water samples in Discovery Bay; assessment of results.
  - Study of the Rio Cobre between Ewarton and Spanish Town.
- Five days of analytical and field work while based on the Mona Campus.
  - Analyse samples collected from the Rio Cobre; collate and assess water quality data.
  - Field trip to the Port Royal mangroves. Take in-field measurements of water parameters; view and qualitatively assess sediment and biological activities.

Evaluation:

- Literature review 10%
- One one-hour course test 20%
- Field reports 30%
- Data Interpretation reports 40%

CHEM3711 **CHEMISTRY UNDERGRADUATE RESEARCH PROJECT**

(6 Credits over two semesters) Semesters 1 & 2 or 2 & 3. Level III

Pre-requisites: Majoring in Chemistry; Completion of all compulsory Level II courses AND at least 6 credits from Level III AND HOD Approval.
It is recommended that in the semester prior to enrolling in this course candidates discuss suitable topics with potential academic supervisors.

Course Content: This course covers the following topics:

- Research methods and Ethics. Use of chemical literature. Experiment design.
- Advanced instrumental and chemical investigation techniques. Investigation of an approved chemical research question.
- Preparation of written and oral scientific reports.
- Students will be required to spend at least 6 hours per week in the laboratory for about 22 weeks.

Evaluation:

- Course-work 40%
  - Research notebook 10%
  - 2 Progress reports 10%
  - Supervisor's assessment 20%
- Research Report 40%
- Oral examination 20%

OCCUPATIONAL AND ENVIRONMENTAL SAFETY AND HEALTH (OESH)

Bachelor of Science

The B.Sc. programme delivers the knowledge and skills to apply OESH competencies in business enterprises and government agencies. These generalists are able to develop, implement and manage basic programmes and to assist in the provision of training and consultancy services.

Entry Requirements

In order to be admitted into the Bachelor's programme, candidates must have satisfied the general Faculty entry requirements and have passed two units of Chemistry, Biology or Physics at CAPE (or equivalent).

Graduates of this programme will form a core of professionals who will be competent in:

- The recognition, evaluation and provision of basic control options for workplace hazards;
- The development, implementation and management of basic OESH programmes;
- The provision of OESH training;
- Assisting in the provision of OESH consultancy services.

Programme Structure

The programme runs for three (3) years full-time and is divided into two (2) levels. Level I consists of seven (7) courses which must be completed in year one, while Levels II and III consist of twenty (20) courses plus a practicum, which are completed in years 2 and 3. Most year three courses focus on professional development in OESH. The part-time option runs over six (6) years.

The BSc. OESH Programme requires 123 credits.

LEVEL1 **(39 Credits)**

Semester 1

OESH1000	Introduction to OESH	(6 Credits)
BIOL1017	Cell Biology	(3 Credits)
BIOL1018	Molecular Biology and Genetics	(3 Credits)
CHEM1901	Introductory Chemistry A	(6 Credits)

Semester 2

CHEM1902	Introductory Chemistry B	(6 Credits)
BIOL1262	Living Organisms I	(3 Credits)
BIOL1263	Living Organisms II	(3 Credits)
GEOG1132	Human Geography II: World Economy, Agriculture and Food	(3 Credits)
GEOG1232	Earth Environments II: Climate and the Biosphere	(3 Credits)
	Foundation Course	(3 Credits)

Summer This period may be used to do any make-up courses

LEVEL II **(42 Credits)**

Semester 1

CHEM2010	Chemical Analysis A	(3 Credits)
CHEM2011	Chemical Analysis Laboratory I	(2 Credits)
OESH2000	Environmental Contaminants and Control	(8 Credits)
COMM2926	Organizational Communication (Dept. of Media and Communication)	(3 Credits)
BIOL2403	Principles of Ecology	(3 Credits)

Semester 2

CHEM3010	Chemical Analysis B	(3 Credits)
CHEM3011	Chemical Analysis Laboratory II	(2 Credits)
PHAL3306	Toxicology (Department of Basic Medical Sciences)	(4 Credits)
BIOL2252	Eukaryotic Microorganisms	(4 Credits)
	Foundation Course	(3 Credits)

Summer

PSYC1002	Introduction to Industrial/Organizational Psychology	(3 Credits)
MDSC3200	Understanding Research	(3 Credits)

LEVEL III (42 Credits)

Semester 1

OESH3200	Occupational Safety Evaluation and Measurement	(4 Credits)
OESH3100	Environment Hazard Evaluation and Risk Management and Control	(4 Credits)
OESH3030	Workplace Survey and Evaluation	(4 Credits)
OESH3220	Occupational Hygiene	(4 Credits)
MGMT3025	Labour and Employment (and Environment) Laws	(3 Credits)

Semester 2

OESH3010	Occupational and Environmental Health Disorders	(4 Credits)
OESH3020	OESH Measurement Methods	(4 Credits)
OESH3040	Disaster and Emergency Management	(4 Credits)
OESH3210	Ergonomics	(4 Credits)
	Foundation Course	(3 Credits)

Summer

OESH3430	Practicum	(4 Credits)

CHEMISTRY DEPARTMENT SCHOLARSHIPS & AWARDS

- THE CHEMISTRY DEPARTMENT PRIZE
- THE CEDRIC HASSALL PRIZE
- THE WILFRED CHAN AWARD
- THE GARFIELD SADLER AWARD
- THE WILLARD PINNOCK PRIZE
- THE BERT FRASER-REID PRIZE
- THE LEONARD J. HAYNES AWARD
- THE PAVELICH/HONKAN PRIZE
- THE GERALD LALOR SCHOLARSHIP
- THE KENNETH MAGNUS SCHOLARSHIP
- THE EARLE ROBERTS SCHOLARSHIP
- THE TARA DASGUPTA SCHOLARSHIP

The Chemistry Department reserves the right to determine the awards that are offered each year.