DEPARTMENT OF

CHEMISTRY

PROGRAMMES

**Majors and B.Scs.**

1. [Applied Chemistry (Major)](#APPLIED_CHEMISTRY_MAJOR)
2. [Chemistry with Education (B.Sc.)](#CHEMISTRY_WITH_EDUCATION)
3. [Chemistry and Management (B.Sc.)](#CHEMISTRY_AND_MANAGEMENT)
4. [Environmental Chemistry (Major)](#ENVIRONMENTAL_CHEMISTRY)
5. [Food Chemistry (Major)](#FOOD_CHEMISTRY)
6. [General Chemistry (Major)](#MAJOR_IN_CHEMISTRY)
7. [Occupational and Environmental Safety and Health (B.Sc.)](#OCCUPUTIONAL_ENVIRONMENTAL_SAFETY_HEALTH)
8. [Special Chemistry (B.Sc.)](#SPECIAL_CHEMISTRY)

**Minors**

1. [Environmental Chemistry](#ENVIRONMENTAL_CHEMISTRY_MINOR)
2. [Food Chemistry](#FOOD_CHEMISTRY_MINOR)
3. [Food Processing](#FOOD_PROCESSING_MINOR)
4. [General Chemistry](#GENERAL_CHEMISTRY_MINOR)
5. [Industrial Chemistry](#INDUSTRIAL_CHEMISTRY_MINOR)

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| **UNDERGRADUATE COURSES OFFERED BY THE DEPARTMENT OF CHEMISTRY** | | | | | |
| **CODES** | **TITLES** | | **CREDITS** | **SEMESTER OFFERED** | **PREREQUISITES**  **(COREQUISITES)** |
| **PRELIMINARY** | | | | | |
| CHEM0901 | | Preliminary Chemistry A | 6-P | 1 | CSEC (CXC) Chemistry Grade 3 or better or approved equivalents |
| CHEM0902 | | Preliminary Chemistry B | 6-P | 2 | CSEC (CXC) Chemistry Grade 3 or better or approved equivalents |
| **LEVEL 1** | | | | | |
| CHEM1810 | | Introductory Chemistry I | 2 | 1 | CHEM0901 and CHEM0902, or CAPE Chemistry I & II, or GCE A-level Chemistry |
| CHEM1811 | | Introductory Chemistry Laboratory I | 2 | 1 | CHEM0901 and CHEM0902, or CAPE  Chemistry I & II or GCE A-level Chemistry, (CHEM1810) |
| CHEM1820 | | Introductory Chemistry II | 2 | 1 | CHEM0901 and CHEM0902, or CAPE  Chemistry I & II or GCE A-level Chemistry |
| CHEM1910 | | Introductory Chemistry III | 2 | 2 | CHEM0901 and CHEM0902, or CAPE  Chemistry I & II or GCE A-level Chemistry |
| CHEM1911 | | Introductory Chemistry Laboratory II | 2 | 2 | CHEM0901 and CHEM0902, or CAPE  Chemistry I & II or GCE A-level Chemistry, CHEM1810, CHEM1820, CHEM1811, (CHEM1910, CHEM1920) |
| CHEM1920 | | Introductory Chemistry IV | 2 | 2 | CHEM0901 and CHEM0902, or CAPE  Chemistry I & II or GCE A-level Chemistry |
| **LEVEL 2** | | | | | |
| CHEM2010 | | Chemical Analysis A | 3 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920, CHEM1911 or CHEM1901 and CHEM1902; FOUN1014 or FOUN1019 |
| CHEM2011 | | Chemical Analysis Laboratory I | 2 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920 and CHEM1911 or CHEM1901 and CHEM1902; FOUN1014 or FOUN1019; (CHEM2010) |
| CHEM2110 | | Inorganic Chemistry A | 3 | 2 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920 and CHEM1911 or CHEM1901 and CHEM19021 |
| **CODES** | | **TITLES** | **CREDITS** | **SEMESTER OFFERED** | **PREREQUISITES**  **(COREQUISITES)** |
| CHEM2111 | | Inorganic Chemistry Laboratory I | 2 | 2 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920 and CHEM1911 or CHEM1901 and CHEM1902(CHEM2110) |
| CHEM2210 | | Organic Chemistry A | 3 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920, and CHEM1911 or CHEM1901 and CHEM1902 |
| CHEM2211 | | Organic Chemistry Laboratory I | 2 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920 and CHEM1911 or CHEM1901 and CHEM1902(CHEM2210) |
| CHEM2310 | | Physical Chemistry A | 3 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920 and CHEM1911 |
| CHEM2311 | | Physical Chemistry Laboratory I | 2 | 2 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920 and CHEM1911 or CHEM1901 and CHEM1902 (CHEM2310) |
| CHEM2402 | | Chemistry in our Daily Lives | 3 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920 and CHEM1911 or CHEM1901 and CHEM1902 |
| CHEM2410 | | Water Treatment | 4 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920, CHEM1911 or CHEM1901 and CHEM1902 and Permission of HOD |
| CHEM2510 | | Food Processing Principles I | 3 | 2 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920, CHEM1911 or CHEM1901 and CHEM1902 and Permission of HOD |
| CHEM2511 | | Food Processing Laboratory | 3 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920, CHEM1911 or CHEM1901 and CHEM1902 and Permission of HOD (CHEM2512) |
| CHEM2512 | | Food Processing Principles II | 3 | 1 | CHEM1810, CHEM1820, CHEM1811, CHEM1910, CHEM1920, CHEM1911 or CHEM1901 and CHEM1902 and Permission of HOD |
| **LEVEL 3** | | | | | |
| CHEM3010 | | Chemical Analysis B | 3 | 2 | CHEM2010 |
| CHEM3011 | | Chemical Analysis Laboratory II | 2 | 2 | CHEM2010 Pass or Fail, but not Fail Absent; CHEM2011; (CHEM3010) |
| **CODES** | | **TITLES** | **CREDITS** | **SEMESTER OFFERED** | **PREREQUISITES**  **(COREQUISITES)** |
| CHEM3110 | | Inorganic Chemistry B | 3 | 1 | CHEM2110 |
| CHEM3111 | | Inorganic Chemistry Laboratory II | 2 | 2 | CHEM2111 and Permission of HOD; (CHEM3112 or CHEM3312) |
| CHEM3112 | | The Inorganic Chemistry of Biological Systems | 3 | 2 | CHEM2110, CHEM2111 and CHEM3110 |
| CHEM3210 | | Organic Chemistry B | 3 | 2 | CHEM2210, Pass or Fail, but not Fail Absent |
| CHEM3211 | | Organic Chemistry Laboratory II | 2 | 2 | CHEM2210, CHEM2211 and CHEM3210 and Permission of HOD; (CHEM3212 or CHEM3213) |
| CHEM3212 | | Natural Products Chemistry | 3 | 2 | CHEM2210, CHEM2211 and CHEM3210 and Permission of HOD |
| CHEM3213 | | Applications of Organic Chemistry in Medicine and Agriculture | 3 | 1 | CHEM2210, CHEM2211 and CHEM3210 and Permission of HOD |
| CHEM3310 | | Physical Chemistry B | 3 | 2 | CHEM2310, Pass or Fail, but not Fail Absent |
| CHEM3311 | | Physical Chemistry Laboratory II | 2 | 1 | CHEM2311 and Permission of HOD; (CHEM3312 or CHEM3313) |
| CHEM3312 | | Chemistry of Materials | 3 | 1 | CHEM2310 and CHEM2110 and Permission of HOD |
| **CODES** | | **TITLES** | **CREDITS** | **SEMESTER OFFERED** | **PREREQUISITES**  **(COREQUISITES)** |
| CHEM3313 | | Topics in Advanced Physical Chemistry | 3 | 2 | CHEM2310 and CHEM3310 and Permission of HOD |
| CHEM3401 | | Project Evaluation And Management For Science- based Industries | 4 | 1 | 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 or CHEM2512 + CHEM2511 OR CHEM3402 and Permission of HOD |
| CHEM3402 | | The Chemical Industries | 4 | 2 | Any two of: CHEM2010 + CHEM2011, CHEM2110 + CHEM2111, CHEM2210 + CHEM2211 or CHEM2310 + CHEM2311; Permission of HOD |
| CHEM3403 | | Chemical Process Principles | 8 | 2 | CHEM2310 and CHEM2311 and Permission of HOD |
| CHEM3510 | | Food Chemistry I | 3 | 1 | CHEM2010 + CHEM2011 and CHEM2210 + CHEM2211 and Permission of HOD |
| CHEM3511 | | Food Chemistry Laboratory | 3 | 2 | Permission of HOD; (CHEM3510 and CHEM3512) |
| CHEM3512 | | Food Chemistry II | 3 | 2 | CHEM2010 + CHEM2011 and CHEM2210 + CHEM2211 and Permission of HOD |
| **CODES** | | **TITLES** | **CREDITS** | **SEMESTER OFFERED** | **PREREQUISITES**  **(COREQUISITES)** |
| CHEM3513 | | Food Safety and Quality Assurance | 3 | 2 | CHEM2510 OR CHEM2512 + CHEM2511 and Permission of HOD |
| CHEM3610 | | Marine and Freshwater Chemistry | 3 | 1 | CHEM2010 + CHEM2011 and any one of the following: CHEM2110, CHEM2210,  CHEM2310 or CHEM3010 |
| CHEM3611 | | Environmental Chemistry Laboratory | 2 | 1 | Permission of HOD; (CHEM3610) |
| CHEM3612 | | Atmospheric Chemistry and Biogeochemical Cycles | 6 | 2 | CHEM3610 or a combination of CHEM2410, CHEM3010 and CHEM2310; Permission of HOD |
| CHEM3621 | | Marine and Freshwater Chemistry Field Course | 2 | 3 | CHEM3610 or CHEM3612; Permission of HOD |
| CHEM3711 | | Chemistry Undergraduate Research Project | 6 | 1 & 2 or 2 & 3 | Majoring in Chemistry; 20 Advanced Credits in Chemistry and Permission of HOD |
| OESH1000 | | Introduction to Occupational and Environmental Safety and Health | 6 | 2 | none |
| OESH2000 | | Environmental Contaminants | 1 & 2 | 9 | CHEM2010 + CHEM2011; The course requirements are met by doing CHEM3610, CHEM3611 and CHEM2410 |
| OESH3010 | | Occupational and Environmental Health Disorders | 2 | 4 | OESH 1000 |
| OESH3020 | | Occupational and Environmental Safety and Health Measurement Methods | 2 | 4 | OESH 3220 |
| OESH3030 | | Workplace Survey and Evaluation | 1 | 4 | OESH3200 |
| OESH3040 | | Disaster and Emergency Management | 2 | 4 | GEOG1231 and GEOG1232 |
| OESH3100 | | Environment Hazard Evaluation and Risk Management and Control | 1 | 4 | OESH 1000 |
| OESH3200 | | Occupational Safety Evaluation and Measurement | 1 | 4 | OESH3210 |
| OESH3210 | | Ergonomics | 2 | 4 | OESH 1000 |
| OESH3220 | | Occupational Hygiene | 1 | 4 | OESH 1000 |
| OESH3430 | | Practicum | summer | 4 | Permission of HOD |

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| [APPLIED CHEMISTRY (MAJOR)](#PROGRAMMES) | | |
| Introductory  Courses  (Level 1) | **A major in Applied Chemistry requires a total of eighteen (18) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
| These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| **AND** | |
| MATH - 6 credits from any Level I Mathematics courses (taken in Semester 1 and/or Semester 2) | |
| Advanced Courses  (Levels 2 and 3)  Electives  *Students must ensure that they satisfy the prerequisite courses required for entry to the electives of interest. In most instances, 12 Level 1 credits in the subject of interest are required. One or more advanced courses may also be needed.* | **A major in Applied Chemistry requires a total of forty-three (43) credits from Levels 2 and 3 (including 10 credits from prerequisite courses) and must include:** | |
| **Level 2: twenty-three (23) compulsory credits** | |
| CHEM2010 | Chemical Analysis A (prerequisite) |
| CHEM2011 | Chemical Analysis Laboratory I (prerequisite) |
| CHEM2310 | Physical Chemistry A (prerequisite) |
| CHEM2311 | Physical Chemistry Laboratory I (prerequisite) |
| CHEM2410 | Water Treatment |
| CHEM3010 | Chemical Analysis B |
| CHEM3011 | Chemical Analysis Laboratory II |
| CHEM3402 | The Chemical Industries |
| *CHEM2010, CHEM2011, CHEM2310 and CHEM2311 may be counted as elective credits.* | |
| **Level 3: seventeen (17) compulsory credits** | |
| CHEM3401 | Project Evaluation &  Management for Science-based Industries |
| CHEM3403 | Chemical Process Principles |
| CHEM3610 | Marine & Freshwater Chemistry |
| CHEM3611 | Environmental Chemistry Laboratory |
| **And three (3) additional Level 2 or 3 credits from:** | |
| CHEM2110 | Inorganic Chemistry A |
| CHEM2210 | Organic Chemistry A |
| CHEM2510 | Food Processing Principles I |
| CHEM2511 | Food Processing Laboratory |
| CHEM2512 | Food Processing Principles II |
| CHEM3110 | Inorganic Chemistry B |
| CHEM3112 | The Inorganic Chemistry of Biological Systems |
| CHEM3210 | Organic Chemistry B |
| CHEM3212 | Natural Products Chemistry |
| CHEM3213 | Applications of Organic Chemistry in Medicine & Agriculture |
| CHEM3310 | Physical Chemistry B |
| CHEM3312 | Chemistry of Materials |
| CHEM3313 | Topics In Advanced Physical Chemistry |
| CHEM3510 | Food Chemistry I |
| CHEM3512 | Food Chemistry II |
| CHEM3513 | Food Safety & Quality Assurance |
| CHEM3621 | Marine & Freshwater Chemistry Field Course |
| CHEM3711 | Chemistry Undergraduate Research Project |
| *Major requires thirty (30) credits of specified Applied Chemistry courses along with one Level 2 or 3 elective (≥ 3 credits). Ten (10) credits of prerequisite General Chemistry courses (CHEM2010, CHEM2011, CHEM2310 and CHEM2311) are also required.* | | |

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| **CHEMISTRY WITH EDUCATION (B.Sc.)**  **(FOR TRAINED AND PRE-TRAINED TEACHERS)** | | | | |
| **YR** | **Sem** | **Course Option** | **Trained Teachers Double Option Science Diploma** | **Pre-trained Teachers - CAPE/A ‘ Levels to Qualify** |
| **1** | **1** | **University Foundation Course** | FOUN1101 or FOUN1301 | FOUN1101, FOUN1301 or any other Foundation |
| **Foun. Edu. & Theory (Core Education)** | **3 credits from:**  EDEA2305  EDGC2010  EDCU2013  EDPS2003 | EDPS1003 (3) |
| **Prof. Specialization (methodology)** | EDSC3410 | **-** |
| **Prof. Specialization (practicum)** | **-** | EDTL1020 (3) |
| **Faculty of Science and Technology** | Level 1 MATH (3)  CHEM1810 (2), CHEM1820 (2), CHEM1811 (2) | Level 1 MATH (3)  CHEM1810 (2), CHEM1820 (2), CHEM1811 (2) |
| **2** | **University Foundation Course** | FOUN1014 (3) | FOUN1014 (3) |
| **Foun. Edu. & Theory**  **(Core Education)** | EDTK2025 | - |
| **Prof. Specialization (methodology)** | EDSC3403  EDSC3408 | EDSC2407(3) |
| **Prof. Specialization (practicum)** | **-** | EDTL1021(3) |
| **Faculty of Science and Technology** | Level 1 MATH (3)  CHEM1910 (2), CHEM1920 (2), CHEM1911 (2) | Level 1 MATH (3)  CHEM1910 (2), CHEM1920 (2), CHEM1911 (2) |
| **2** | **1** | **University Foundation Course** | - | - |
| **Foun. Edu. & Theory (Core Education)** | - | EDME2006 |
| **Prof. Specialization (methodology)** | - | - |
| **Prof. Specialization (practicum)** | EDTL3020 (3)  EDTL3021 (3) | - |
| **Chemistry** | CHEM2010 (3)  CHEM2011 (2)  CHEM2210 (3)  CHEM2211 (2)  CHEM2310 (3) | CHEM2010 (3)  CHEM2011 (2)  CHEM2210 (3)  CHEM2211 (2)  CHEM2310 (3) |
| **2** | **University Foundation** | - | FOUN1101, FOUN1301 or any other that is available |
| **Foun. Edu. & Theory (Core Education)** | - | EDRS2007 |
| **Prof.**  **Specialization (methodology)** | EDSC3411  EDSC3417 | EDSC3403 |
| **Prof.**  **Specialization (practicum)** | EDRS3019 | EDTL2021  \*Students in schools Monday to Thursday starting week 7 |
| **Chemistry** | CHEM2311 **(2)**  CHEM2110 **(3)**  CHEM2111 **(2)**  CHEM2510 **(3)** | CHEM2311 **(2)**  CHEM2110 **(3)**  CHEM2111 **(2)** |
| **3** | **1** | **University Foundation** | **-** | **-** |
| **Foun. Edu. & Theory (Core Education)** | - | - |
| **Prof.**  **Specialization (methodology)** | **-** | EDSC3410 |
| **Prof.**  **Specialization (practicum)** | **-** | EDTL3018 (9)  \*full immersion Monday to Thursday  EDRS3020 [3 credits] |
| **Chemistry** | - | - |
| **2** | **University Foundation** |  | FOUN1101, FOUN1301 or any other Foundation |
| **Foun. Edu. & Theory (Core Education)** | - | - |
| **Prof. Specialization (methodology)** | - | EDSC3417 |
| **Prof. Specialization (practicum)** | - | - |
| **Chemistry** | CHEM3010 **(3)**  CHEM3011 **(2)**  **PLUS**  **An additional 4 or 5 Level II/III credits** | CHEM3010 **(3)**  CHEM3011 **(2)**  CHEM2510 **(3)**  **PLUS**  **An additional 4/5 Level II/III credits** |
| ***Note: Please consult the Faculty of Humanities and Education starting in year one regarding the selection of Education (ED...) courses.*** | | | | |

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

**Pre-Trained Teacher:** 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 by full immersion in their final year for 6 and 10 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. During their final year students complete a lesson study where they plan, implement and evaluate a specific lesson they have taught while on field work.

**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.

***N.B.***

***Candidates who have completed the New Double Option Science diploma programmes from The MICO University College or Church Teachers College (with a GPA ≥ 2.5) may be exempt from Level 1 Chemistry courses.***

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| CHEMISTRY AND MANAGEMENT (B.Sc.) | | |
| Introductory  Courses  (Level 1) | **A B.Sc. in Chemistry and Management requires a total thirty-six (36) compulsory Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
| These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| STAT1001 | Statistics for Scientists |
| ACCT1003\* | Introduction to Cost Management and Accounting |
| ACCT1005\* | Introduction to Financial Accounting |
| ECON1000\* | Principles of Economics |
| ECON1012\* | Principles of Economics II |
| PSYC1002\* | Introduction to Industrial and Organization Psychology |
| SOCI1002\* | Sociology for the Caribbean |
| **AND** | |
| MATH - 3 credits from any Level I Mathematics courses (taken in Semester 1 or Semester 2) | |
| Advanced Courses  (Levels 2 and 3) | **A B.Sc. in Chemistry and Management requires a total of sixty-two (62) credits from Levels 2 and 3 and must include:** | |
| **Level 2: forty-one (41) compulsory credits** | |
| 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 |
| MKTG2001\* | Principles of Marketing |
| MGMT2004\* | Computer Application |
| MGMT2008\* | Organizational Behaviour |
| MGMT2012\* | Introduction to Quantitative Methods |
| MGMT2021\* | Business Law I |
| MGMT2023\* | Financial Management 1 |
| MGMT2026\* | Introduction to Production & Operations Management |
| **Level 3: eighteen (18) compulsory credits** | |
| **Nine (9) credits from:** | |
| CHEM3010 | Chemical Analysis B |
| CHEM3110 | Inorganic Chemistry B |
| CHEM3210 | Organic Chemistry B |
| CHEM3310 | Physical Chemistry B |
| **Plus six (6) additional credits from:** | |
| MGMT3031\* | Business Strategy and Policy |
| MGMT3058\* | New Venture Management |
| Electives  *Students must ensure that they satisfy the prerequisite courses required for entry to the electives of interest. In most instances, 12 Level 1 credits in the subject of interest are required. One or more advanced courses may also be needed.* | **And three (3) additional Level 2 or 3 credits from:** | |
| **CODE** | **COURSE TITLE** |
| CHEM2410 | Water Treatment |
| CHEM2510 | Food Processing Principles I |
| CHEM2511 | Food Processing Laboratory |
| CHEM2512 | Food Processing Principles II |
| CHEM3112 | The Inorganic Chemistry of Biological Systems |
| CHEM3212 | Natural Products Chemistry |
| CHEM3213 | Applications of Organic Chemistry in Medicine & Agriculture |
| CHEM3312 | Chemistry of Materials |
| CHEM3313 | Topics In Advanced Physical Chemistry |
| CHEM3402 | The Chemical Industries |
| CHEM3510 | Food Chemistry I |
| CHEM3512 | Food Chemistry II |
| CHEM3610 | Marine & Freshwater Chemistry |
| CHEM3612 | Atmospheric Chemistry & Biogeochemical Cycles |
| CHEM3011 | Chemical Analysis Laboratory II |
| CHEM3111 | Inorganic Chemistry Laboratory II |
| CHEM3211 | Organic Chemistry Laboratory II |
| CHEM3311 | Physical Chemistry Laboratory II |
| CHEM3511 | Food Chemistry Laboratory |
| CHEM3611 | Environmental Chemistry Laboratory |
| CHEM3621 | Marine and Freshwater Chemistry Field Course |
| CHEM3711 | Chemistry Undergraduate Research Project |
| **And 3 additional credits from Level 2 or 3 Management Studies Courses.** | |
| *\*Courses are offered by the Faculty of Social Sciences* | | |

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| ENVIRONMENTAL CHEMISTRY (MAJOR) | | |
| Introductory  Courses  (Level 1) | **A major in Environmental Chemistry requires a total of eighteen (18) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory I |
| These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| **AND** | |
| MATH - 6 credits from any Level I Mathematics courses (taken in Semester 1 and/or Semester 2) | |
| Advanced Courses  (Levels 2 and 3) | **A major in Environmental Chemistry requires a total of forty-eight (48) credits from Levels 2 and 3 and must include:** | |
| **Level 2: thirty-one (31) compulsory credits** | |
| CHEM2010 | Chemical Analysis A |
| CHEM2011 | Chemical Analysis Laboratory I |
| CHEM2110 | Inorganic Chemistry A |
| CHEM2210 | Organic Chemistry A |
| CHEM2310 | Physical Chemistry A |
| CHEM2410 | Water Treatment |
| CHEM3010 | Chemical Analysis B |
| CHEM3011 | Chemical Analysis Laboratory II |
| CHEM3402 | The Chemical Industries |
| **Plus four (4) credits from:** | |
| CHEM2111 | Inorganic Chemistry Laboratory |
| CHEM2211 | Organic Chemistry Laboratory I |
| CHEM2311 | Physical Chemistry Laboratory I |
| **Level 3: eleven (11) compulsory credits** | |
| CHEM3610 | Marine and Freshwater |
| CHEM3611 | Chemistry Laboratory |
| CHEM3612 | Atmospheric Chemistry &  Biogeochemical Cycle |
| **And six (6) additional credits from Level 2 or 3 taken from environmental courses including but not limited to:** | |
| CHEM3621 | Marine and Freshwater Chemistry Field Course |
| CHEM3711 | Chemistry Undergraduate Research Project (Project must be environment-based) |
| BIOL2402 | Fundamentals of Biometry |
| BIOL2403 | Principles of Ecology |
| BIOL3405 | Pest Ecology and Management |
| BIOL3406 | Freshwater Biology |
| BIOL3407 | Oceanography |
| BIOL3408 | Coastal Systems |
| BIOL3409 | Caribbean Coral Reefs |
| BIOL3410 | Water Pollution Biology |
| BOTN3403 | Fundamentals of Horticulture |
| BOTN3404 | Economic Botany |
| BOTN3405 | Plant Ecophysiology |
| BIOL2402 | Fundamentals of Biometry |
| BIOL2403 | Principles of Ecology |
| GEOG2131 | Urban Geography |
| GEOG2232 | Climate Change |
| GEOG3132 | Tourism Planning & Development |
| GGEO2233 | Water Resources |
| GGEO3232 | Climate Change in the Tropics |
| GGEO3233 | Hydrology and Hydrological Geology |
| PHYS3661 | Physics of the Atmosphere and Climate |
| PHYS3671 | Solar Power |
| PHYS3681 | Wind and Hydro Power |
| *Major requires 24 credits of specified Environmental courses along with 6 credits from Level 2 or 3 approved environment related electives. There are 14 credits of defined prerequisite courses (CHEM2010, CHEM2011, CHEM2110, CHEM2210, and CHEM2310); an additional 4 credits from Level 2 laboratory electives are also required.* | | |

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| FOOD CHEMISTRY (MAJOR) | | |
| Introductory  Courses  (Level 1) | **A major in Food Chemistry requires a total of eighteen (18) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
| These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| **AND** | |  |
| MATH - 6 credits from any Level I Mathematics courses (taken in Semester 1 and/or Semester 2) | |
| Advanced Courses  (Levels 2 and 3) | **A major in Food Chemistry requires a total of forty-four (44) credits from Levels 2 and 3 (including 10 credits from prerequisite courses) and must include:** | |
| **Level 2: twenty-four (24) compulsory credits** | |
| CHEM2010 | Chemical Analysis A (prerequisite) |
| CHEM2011 | Chemical Analysis Laboratory I (prerequisite) |
| CHEM2210 | Organic Chemistry A (prerequisite) |
| CHEM2211 | Organic Chemistry Laboratory I (prerequisite) |
| CHEM2510 | Food Processing Principles I |
| CHEM2511 | Food Processing Laboratory |
| CHEM2512 | Food Processing Principles II |
| CHEM3010 | Chemical Analysis B |
| CHEM3011 | Chemical Analysis Laboratory II |
| **Level 3: twenty (20) Compulsory Credits** | |
| CHEM2410 | Water Treatment |
| CHEM3401 | Project Evaluation & Management for Science-based Industries |
| CHEM3510 | Food Chemistry I |
| CHEM3511 | Food Chemistry Laboratory |
| CHEM3512 | Food Chemistry II |
| CHEM3513 | Food Safety and Quality Assurance |
| *Major requires thirty-four (34) credits of specialized Food Chemistry courses supported by 10 prerequisite credits of General Chemistry (CHEM2010, CHEM2011, CHEM2210, and CHEM2211).* | | |

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| MAJOR IN GENERAL CHEMISTRY | | |
| Introductory  Courses  (Level 1) | **A major in General Chemistry requires a total of eighteen (18) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
| These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| **AND** | |
| MATH - 6 credits from any Level I Mathematics courses (taken in Semester 1 and/or Semester 2) | |
| Advanced Courses  (Levels 2 and 3) | **A major in General Chemistry requires a minimum of thirty-nine (39) credits from Levels 2 and 3 and must include:** | |
| **Level 2: twenty (20) credits** | |
| 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 |
| **Level 3: minimum of nineteen (19) Credits** | |
| **At least six (6) Level 3 credits from:** | |
| CHEM3010 | Chemical Analysis B |
| CHEM3110 | Inorganic Chemistry B |
| CHEM3210 | Organic Chemistry B |
| CHEM3310 | Physical Chemistry B |
| **At least four (4) Level 3 credits from:** | |
| CHEM3011 | Chemical Analysis Laboratory II |
| CHEM3111 | Inorganic Chemistry Laboratory II |
| CHEM3211 | Organic Chemistry Laboratory II |
| CHEM3311 | Physical Chemistry Laboratory II |
| **At least three (3) Level 3 credits from:** | |
| CHEM3112 | The Inorganic Chemistry of  Biological Systems |
| CHEM3212 | Natural Products Chemistry |
| CHEM3213 | Applications of Organic Chemistry in Medicine and Agriculture |
| CHEM3312 | Chemistry of Materials |
| CHEM3313 | Topics in Advanced  Physical Chemistry |
| Electives  *Students must ensure that they satisfy the prerequisite courses required for entry to the electives of interest. In most instances, 12 Level 1 credits in the subject of interest are required. One or more advanced courses may also be needed.* | **And six (6) additional Level 2 or 3 credits from:** | |
| CHEM2410 | Water Treatment |
| CHEM2510 | Food Processing Principles I |
| CHEM2511 | Food Processing Laboratory |
| CHEM2512 | Food Processing Principles II |
| CHEM3112 | The Inorganic Chemistry of Biological Systems |
| CHEM3212 | Natural Products Chemistry |
| CHEM3213 | Applications of Organic Chemistry in Medicine & Agriculture |
| CHEM3312 | Chemistry of Materials |
| CHEM3313 | Topics In Advanced Physical Chemistry |
| CHEM3402 | The Chemical Industries |
| CHEM3510 | Food Chemistry I |
| CHEM3512 | Food Chemistry II |
| CHEM3610 | Marine & Freshwater Chemistry |
| CHEM3612 | Atmospheric Chemistry & Biogeochemical Cycles |
| CHEM3111 | Inorganic Chemistry Laboratory II |
| CHEM3211 | Organic Chemistry Laboratory II |
| CHEM3311 | Physical Chemistry Laboratory II |
| CHEM3511 | Food Chemistry Laboratory |
| CHEM3611 | Environmental Chemistry Laboratory |
| CHEM3621 | Marine and Freshwater Chemistry Field Course |
| CHEM3711 | Chemistry Undergraduate Research Project |
| *Major requires 20 Level 2 credits consisting 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 3, students take 10 credits of core chemistry (inclusive of 4 credits in laboratory courses) and 9 credits in electives.* | | |

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| OCCUPATIONAL AND ENVIRONMENTAL SAFETY AND HEALTH (B.Sc.) | | |
| Introductory  Courses  (Level 1) | **A B.Sc. in** **Occupational and Environmental Safety and Health requires a total of thirty-nine (36) Level 1 credits from:** | |
| BIOL1017 | Cell Biology |
| BIOL1262 | Living Organisms I |
| BIOL1263 | Living Organisms II |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
| These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| GEOG1231 | Earth Environments I: Geomorphology and Soil |
| GEOG1232 | Earth Environments II: Climate and the Biosphere |
| OESH1000 | Introduction to OESH |
| *Foundation Course* (FOUN1014 or FOUN1019) | |
| Advanced Courses  (Levels 2 and 3) | **A B.Sc. in Occupational and Environmental Safety and Health requires a total of seventy-three (73) credits from Levels 2 and 3 and must include:** | |
| **Year 2: thirty (31) compulsory credits** | |
| BIOL2406 | Eukaryotic Microorganisms |
| BIOL2403 | Principles of Ecology |
| CHEM2010 | Chemical Analysis A |
| CHEM2011 | Chemical Analysis Laboratory I |
| CHEM3010 | Chemical Analysis B |
| CHEM3011 | Chemical Analysis Laboratory II |
| LANG3101\* | Business Communication: Principles and Practices |
| OESH3200 | Occupational Safety Evaluation and Measurement |
| OESH3220 | Occupational Hygiene |
| PHAL3306\*\* | Toxicology |
| *Foundation Course* | |
| **Year 2: Summer: six (6) credits** | |
| PSYC1002 | Introduction to Industrial and Organizational |
| MDSC3200\*\* | Understanding Research |
| **Year 3:** **thirty-six (36) credits** | |
| OESH2000 | Environmental Contaminants |
| OESH3010 | Occupational and Environmental Health Disorders |
| OESH3020 | OESH Measurement Methods |
| OESH3030 | Workplace Survey and Evaluation |
| OESH3040 | Disaster and Emergency Management |
| OESH3100 | Environment Hazard Evaluation and Risk Management and Control |
| OESH3210 | Ergonomics |
| MGMT3063\*\*\* | Labour and Employment Law |
| *Foundation Course* | |
| **Level 3: Summer: four (4) credits** | |
| OESH3430 | Practicum |
| *\*Course offered by the Faculty of Humanities and Education.*  *\*\* Course offered by the Faculty of Medical Sciences.*  *\*\*\* Course offered by the Faculty of Social Sciences.* | | |

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| SPECIAL CHEMISTRY (B.Sc.) | | |
| Introductory  Courses  (Level 1) | **A B.Sc. in Special Chemistry requires a total of eighteen (18) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
| These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| MATH - 6 credits from any Level I Mathematics courses (taken in Semester 1 and/or Semester 2)  PHYS - CAPE Physics or equivalent is required. | |
| **A B.Sc. in Special Chemistry requires a total of fifty-four (54) credits from Levels 2 and 3 and must include:** | |
| Advanced Courses  (Levels 2 and 3) | **Level 2: twenty (20) compulsory credits** | |
| 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 |
| **Level 3: twenty (20) compulsory credits** | |
| CHEM3010 | Chemical Analysis B |
| CHEM3011 | Chemical Analysis Laboratory II |
| CHEM3110 | Inorganic Chemistry B |
| CHEM3210 | Organic Chemistry B |
| CHEM3310 | Physical Chemistry B |
| CHEM3711 | Chemistry Undergraduate Research Project |
| **At least four (4) Level 3 credits from:** | |
| CHEM3111 | Inorganic Chemistry Laboratory II |
| CHEM3211 | Organic Chemistry Laboratory II |
| CHEM3311 | Physical Chemistry Laboratory II |
| **And ten (10) additional Level 2 or 3 credits from :** | |
| CHEM2410 | Water Treatment |
| CHEM2510 | Food Processing Principles I |
| CHEM2511 | Food Processing Laboratory |
| CHEM2512 | Food Processing Principles II |
| CHEM3112 | The Inorganic Chemistry of Biological Systems |
| CHEM3212 | Natural Products Chemistry |
| CHEM3213 | Applications of Organic Chemistry in Medicine & Agriculture |
| CHEM3312 | Chemistry of Materials |
| CHEM3313 | Topics In Advanced Physical Chemistry |
| CHEM3402 | The Chemical Industries |
| CHEM3510 | Food Chemistry I |
| CHEM3512 | Food Chemistry II |
| CHEM3610 | Marine & Freshwater Chemistry |
| CHEM3612 | Atmospheric Chemistry & Biogeochemical Cycles |
| CHEM3111 | Inorganic Chemistry Laboratory II |
| CHEM3211 | Organic Chemistry Laboratory II |
| CHEM3311 | Physical Chemistry Laboratory II |
| CHEM3511 | Food Chemistry Laboratory |
| CHEM3611 | Environmental Chemistry Laboratory |
| CHEM3621 | Marine and Freshwater Chemistry Field Course |
| CHEM3711 | Chemistry Undergraduate Research Project |
| **And six (6) credits from Level 2 courses in another subject area in science or Mathematics.** | |
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| ENVIRONMENTAL CHEMISTRY (MINOR) | | |
| Introductory  Courses  (Level 1) | **A minor in Environmental Chemistry requires a total of twelve (12) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
|  | These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| Advanced Courses  (Levels 2 and 3 ) | **A minor in Environmental Chemistry requires a total of fifteen (15) credits from Levels 2 and 3 and must include:** | |
| CHEM2410 | Water Treatment |
| CHEM3610 | Marine and Freshwater  Chemistry |
| CHEM3611 | Environmental Chemistry Laboratory |
| CHEM3612 | Atmospheric Chemistry & Biogeochemical Cycles |

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| FOOD CHEMISTRY (MINOR) | | |
| Introductory  Courses  (Level 1) | **A minor in Food Chemistry requires a total of twelve (12) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry VI |
| CHEM1811 | Introductory Chemistry Laboratory I |
| CHEM1911 | Introductory Chemistry Laboratory II |
|  | These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| Advanced Courses  (Levels 2 and 3 ) | **A minor in Food Chemistry requires a total of at least sixteen (16) credits from Levels 2 and 3 and must include:** | |
| CHEM3510 | Food Chemistry I |
| CHEM3511 | Food Chemistry Laboratory |
| CHEM3512 | Food Chemistry II |
| **AND at least (7) credits from:** | |
| CHEM2010 | Chemical Analysis A |
| CHEM2011 | Chemical Analysis Laboratory I |
| CHEM2210 | Organic Chemistry A |
| CHEM2211 | Organic Chemistry Laboratory I |
| CHEM2310 | Physical Chemistry A |
| CHEM2311 | Physical Chemistry Laboratory I |
| CHEM2410 | Water Treatment |
| CHEM3010 | Chemical Analysis B |
| CHEM3011 | Chemical Analysis Laboratory II |
| CHEM3210 | Organic Chemistry B |
| CHEM3513 | Food Safety & Quality Assurance |
| *CHEM2010, CHEM2011, CHEM2210 and CHEM2211 are prerequisites for CHEM3510 and CHEM3512.* | | |
| *Minor consists of 16 credits of Advanced courses. The required Level 3 courses explore the chemistry of food components while the additional 7 credits may be selected from Level 2 or Level 3 courses that cover central areas of organic and physical chemistry, chemical analysis, water treatment, instrumental methods or food safety.* | | |

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| FOOD PROCESSING (MINOR) | | |
| Introductory  Courses  (Level 1) | **A minor in Food Processing requires a total of twelve (12) Level 1 credits from:** | |
| |  | | --- | | CHEM1810 | | CHEM1820 | | CHEM1910 | | CHEM1920 | | CHEM1811 | | CHEM1911 | | |  | | --- | | Introductory Chemistry I | | Introductory Chemistry II | | Introductory Chemistry III | | Introductory Chemistry VI | | Introductory Chemistry Laboratory I | | Introductory Chemistry Laboratory II | |
|  | These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| Advanced Courses  (Levels 2 and 3 ) | **A minor in Food Processing requires a total of at least sixteen (16) credits from Levels 2 and 3 and must include:** | |
| CHEM2510 | Food Processing Principles I |
| CHEM2511 | Food Processing Laboratory |
| CHEM2512 | Food Processing Principles II |
| **AND at least seven (7) credits from:** | |
| CHEM2310 | Physical Chemistry A |
| CHEM2311 | Physical Chemistry Laboratory I |
| CHEM2410 | Water Treatment |
| CHEM3401 | Project Evaluation & Management for Science-based Industries |
| CHEM3402 | The Chemical Industries |
| CHEM3403 | Chemical Process Principles |
| CHEM3513 | Food Safety & Quality Assurance |
| *Minor consists of 16 Advanced (Level 2 and Level 3) credits. The compulsory Level 2 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 2 or Level 3 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.* | | |
| GENERAL CHEMISTRY (MINOR) | | |
| Introductory  Courses  (Level 1) | **A minor in General Chemistry requires a total of twelve (12) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
|  | CHEM1911 | Introductory Chemistry Laboratory II |
|  | These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| Advanced Courses  (Levels 2 ) | **A minor in General Chemistry requires a total of at least sixteen (16) credits from Level 2 and must include:** | |
| CHEM2010 | Chemical Analysis A |
| CHEM2011 | Chemical Analysis Laboratory I |
| CHEM2110 | Inorganic Chemistry A |
| CHEM2210 | Organic Chemistry A |
| CHEM2310 | Physical Chemistry A |
| **AND at least two (2) credits from:** | |
| CHEM2111 | Inorganic Chemistry Laboratory I |
| CHEM2211 | Organic Chemistry Laboratory I |
| CHEM2311 | Physical Chemistry Laboratory I |
| *Minor gives students a foundation in analytical chemistry and two of the other traditional sub-disciplines (inorganic, organic and physical chemistry). The minor comprises 12 credits of theory and 4 credits of laboratory from Level 2 core courses.* | | |

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| INDUSTRIAL CHEMISTRY (MINOR) | | |
| Introductory  Courses  (Level 1) | **A minor in Industrial Chemistry requires a total of twelve (12) Level 1 credits from:** | |
| CHEM1810 | Introductory Chemistry I |
| CHEM1820 | Introductory Chemistry II |
| CHEM1910 | Introductory Chemistry III |
| CHEM1920 | Introductory Chemistry IV |
| CHEM1811 | Introductory Chemistry Laboratory I |
|  | CHEM1911 | Introductory Chemistry Laboratory II |
|  | These Level I courses are equivalent to CHEM1901 + CHEM1902. | |
| Advanced Courses  (Level 3 ) | **A minor in Industrial Chemistry requires a total of sixteen (16) credits from Level 3 and must include:** | |
| CHEM3401 | Project Evaluation & Management for Science-based Industries |
| CHEM3402 | The Chemical Industries |
| CHEM3403 | Chemical Process Principles |
| *CHEM2010, CHEM2011, CHEM2310 and CHEM2311 are prerequisites for CHEM3403 and CHEM3402.* | | |
| *Minor consists of 16 compulsory advanced credits. A four-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 and chemical unit operation round out the required courses.* | | |

COURSE DESCRIPTIONS

**CHEM0901 PRELIMINARY CHEMISTRY A**

(6 P-Credits) (Level 0) (Semester 1)

**Pre-requisite:**

CSEC (CXC) Chemistry Grade 3 or better **OR** approved equivalents.

**Course Content:**

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 48 hours.

**Evaluation:**

* Final Written Examination (2 hours) 70%
* Course Work: 30%
  + Assignments 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) (Level 0) (Semester 2)

**Pre-requisite:**

CSEC (CXC) Chemistry Grade 3 or better **OR** approved equivalents.

**Course Content:**

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 48 hours.

**Evaluation:**

* Final Written Examination (2 hours) 70%
* Course Work: 30%
  + Assignments 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.*

**CHEM1810 INTRODUCTORY CHEMISTRY I**

(2 Credits) (Level 1) (Semester 1)

**Pre-requisites:**

CHEM0901 - Preliminary Chemistry A **AND** CHEM0902 - Preliminary Chemistry B **or** CAPE Chemistry (Units 1 and 2) **or** GCE A-level Chemistry or approved equivalents.

**Course Content:**

Introductory Chemistry I discusses the structure and properties of atomic species and examines the fundamental principles that govern bonding in matter. It explains how these concepts give information about the shapes of molecules and helps to influence their characteristics and reactions. The Schrödinger wave equation is used to explore the concept of electron density in atoms and to rationalize the types of bonding that occur between atoms. Fundamental concepts such as periodicity, molecular orbital theory and intermolecular forces are used to help explain the chemical and physical properties of substances and to predict the reactions that they undergo. The various topics are organized logically in order to facilitate meaningful understanding of the course material.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work:
  + In-course Tests 40%

**CHEM1820 INTRODUCTORY CHEMISTRY II**

(2 Credits) (Level 1) (Semester 1)

**Pre-requisites:**

CHEM0901 - Preliminary Chemistry A **AND** CHEM0902 - Preliminary Chemistry B **or** CAPE Chemistry (Units 1 and 2) **or** GCE A-level Chemistry or approved equivalents.

**Course Content:**

Introductory Chemistry II is an introductory level course which explores the fundamental laws, theories and models that govern stability and reactivity in chemical reactions. The course covers Acid-Base theories and explores the principles of Thermodynamics, Electrochemistry and Kinetics. The course includes both descriptive and mathematical components and effectively connects theories with industrial applications. The various topics are logically organized and readily facilitate meaningful understanding of the course material.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work:
  + In-course Tests 40%

**CHEM1811 INTRODUCTORY CHEMISTRY LABORATORY I**

(2 Credits) (Level 1) (Semester 1)

**Pre-requisites:**

CHEM0901 - Preliminary Chemistry A **AND** CHEM0902 - Preliminary Chemistry B **or** CAPE Chemistry (Units 1 and 2) **or** GCE A-level Chemistry or approved equivalents.

**Co-requisites:** CHEM1810

**Course Content:**

This course will expose students to concepts and laboratory skills associated with Analytical and Inorganic Chemistry through exercises and experiments designed to improve experimental skills. These exercises will focus on volumetric analysis and inorganic synthesis and will support and reinforce the content covered in the Introductory Chemistry I and Introductory Chemistry II theory courses through practice and application. The course will be offered over one semester and will include 48 hours of experimental work.

**Evaluation:**

* Final Examination (2 hours) 20%
* Course Work:
  + Pre-laboratory Test 10%
  + Laboratory Reports 70%

*Practical work is assessed throughout the duration of the course. Students must provide the ORIGINAL worksheets of their laboratory work which must be certified by the laboratory course Supervisor or Demonstrator.*

**CHEM1910 INTRODUCTORY CHEMISTRY III**

(2 Credits) (Level 1) (Semester 2)

**Pre-requisites:**

CHEM0901 - Preliminary Chemistry A **AND** CHEM0902 - Preliminary Chemistry B **or** CAPE Chemistry (Units 1 and 2) **or** GCE A-level Chemistry or approved equivalents.

**Course Content:**

Introductory Chemistry III is an introductory level course with a blend of Physical and Inorganic Chemistry. The course covers the fundamentals of atomic and molecular spectroscopy from a quantum mechanical view point, and also examines the inorganic chemistry of main group and first row transition elements.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work:
  + In-course Tests 40%

**CHEM1920 INTRODUCTORY CHEMISTRY IV**

(2 Credits) (Level 1) (Semester 2)

**Pre-requisites:**

CHEM0901 - Preliminary Chemistry A **AND** CHEM0902 - Preliminary Chemistry B **or** CAPE Chemistry (Units 1 and 2) **or** GCE A-level Chemistry or approved equivalents.

**Course Content:**

This course is a mechanistic, principles-based approach to the structures, properties and synthesis of hydrocarbons and compounds functionalized with halogen, hydroxyl, carbonyl, carboxyl, and amino groups. It builds on the material introduced in CAPE Chemistry and aims to encourage students to take an imaginative and creative approach to organic chemistry.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work:
  + In-course Tests 40%

**CHEM1911 INTRODUCTORY CHEMISTRY LABORATORY II**

(2 Credits) (Level 1) (Semester 2)

**Pre-requisites:**

CHEM0901 - Preliminary Chemistry A **AND** CHEM0902 - Preliminary Chemistry B **or** CAPE Chemistry (Units 1 and 2) **or** GCE A-level Chemistry or approved equivalents as well as CHEM1810, CHEM1820, CHEM1811

**Co-requisites:** CHEM1910 and CHEM1920

**Course Content:**

This course combines an integrated science approach which focuses on organic, inorganic and physical chemistry approaches to chemical experimentation. Appropriate laboratory experiments will enable development of students’ practical skills in these sub-disciplines. The experimental bases of many of the concepts introduced in the co-requisite Introductory Chemistry courses, III and IV will be demonstrated and these concepts clarified and reinforced.

**Evaluation:**

* Final Examination (2 hours) 20%
* Course Work:
  + Pre-laboratory Test 10%
  + Laboratory Reports 70%

*Practical work is assessed throughout the duration of the course. Students must provide the ORIGINAL worksheets of their laboratory work which must be certified by the laboratory course Supervisor or Demonstrator.*

**CHEM2010 CHEMICAL ANALYSIS A**

(3 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 - Introductory Chemistry Laboratory II (or CHEM1901 + CHEM1902) **AND** FOUN1014/FOUN1019**.**

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 20%
  + Assignments 20%

**CHEM2011 CHEMICAL ANALYSIS LABORATORY I**

(2 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II

(or CHEM1901 + CHEM1902). **AND** FOUN1014/FOUN1019 **AND** permission of Head of Department.

**Co-requisite:**

CHEM2010 - Chemical Analysis A.

**Course Content:**

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 Skills 25%
* Writing Exercises 25%
* Laboratory Reports 50%

**CHEM2110 INORGANIC CHEMISTRY A**

(3 Credits) (Level 2) (Semester 2)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II (or CHEM1901 + CHEM1902)

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 40%

**CHEM2111 INORGANIC CHEMISTRY LABORATORY I**

(2 Credits) (Semester 2) (Level 2)

**Pre-requisites**:

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II

(or CHEM1901 + CHEM1902).

**Co-requisite:**

CHEM2110 - Inorganic Chemistry A.

**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, and 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:**

* In-course Tests 20%
* Laboratory Reports 80%

**CHEM2210 ORGANIC CHEMISTRY A**

(3 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II (or CHEM1901 + CHEM1902)

**Course Content:**

1. **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.
2. **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.
3. **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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 40%

**CHEM2211 ORGANIC CHEMISTRY LABORATORY I**  
 (2 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II (or CHEM1901 + CHEM1902).

**Co-requisite:**

CHEM2210 - Organic Chemistry A.

**Course Content:**

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:**

* In-course Tests 20%
* Laboratory Reports 80%

**CHEM2310 PHYSICAL CHEMISTRY A**

(3 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II (or CHEM1901 + CHEM1902)

**Course Content:**

1. 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.
2. 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.
3. 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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 40%

**CHEM2311 PHYSICAL CHEMISTRY LABORATORY I**

(2 Credits) (Level 2) (Semester 2)

**Pre-requisite:** CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II **(or CHEM1901 + CHEM1902).**  **AND** CHEM2310 - Physical Chemistry A.

**Course Content:**

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:**

* In-course Tests 20%
* Laboratory Reports 80%

**CHEM2402 CHEMISTRY IN OUR DAILY LIVES**

(3 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II(or CHEM 1901 + CHEM1902).**AND** Permission of Head of Department.

**Course Content:**

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:**

* Final Written Examination (2 hours) 50%
* Course Work: 50%
  + In-course Tests 20%
  + Assignments 30%

*CHEM2402 is open to FST students at the Advanced level who have successfully completed Level 1 (CHEM1810, CHEM1811, CHEM1820, CHEM1910, CHEM1911 and CHEM1920 or CHEM1901 + CHEM1902) Chemistry courses. This course cannot be counted towards a major or minor in Chemistry. The course can, however, be counted as advanced credits within these degrees.*

**CHEM2410 WATER TREATMENT**

(4 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II **or CHEM1901 + CHEM1902 AND** Permission of Head of Department.

**Co-requisites:**

**CHEM2010** -Chemical Analysis A **AND** CHEM2011 - Chemical Analysis Laboratory I.

**Course Content:**

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:**

* Final Written Examination (2 hours) 50%
* Course Work: 50%
  + In-course Tests 20%
  + Laboratory Reports 20%
  + Field Trip Reports 10%

**CHEM2510 FOOD PROCESSING PRINCIPLES I**   
(3 Credits) (Level 2) (Semester 2)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II or CHEM1901 + CHEM1902**AND** Permission of HOD. *Preference will be given to students majoring in Food Chemistry.*

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests (*an assignment may be given*) 40%

**CHEM2511 FOOD PROCESSING LABORATORY**   
(3 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I, CHEM1911 - Introductory Chemistry Laboratory II or CHEM1901 + CHEM1902 **AND** Permission of HOD. *Preference will be given to students majoring in Food Chemistry. A valid food handler’s permit is required for participation in the processing laboratory.*

**Co-requisites:**

CHEM2512 - Food Processing Principles II.

**Course Content:**

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:**

* Oral Presentation 10%
* Research Paper Assignments 15%
* Laboratory and Field Trip Reports 75%

**CHEM2512 FOOD PROCESSING PRINCIPLES II**   
(3 Credits) (Level 2) (Semester 1)

**Pre-requisites:**

CHEM1810 - Introductory Chemistry I,CHEM1820 - Introductory Chemistry II, CHEM1910 - Introductory Chemistry III,CHEM1920 - Introductory Chemistry IV, CHEM1811 - Introductory Chemistry Laboratory I and CHEM1911 – Introductory Chemistry Laboratory II or CHEM1901 + CHEM1902  **AND** Permission of Head of Department. *Preference will be given to students majoring in Food Chemistry.*

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests (*an assignment may be given*) 40%

**CHEM3010 CHEMICAL ANALYSIS B**

(3 Credits) (Level 3) (Semester 1)

**Pre-requisite:**

CHEM2010 - Chemical Analysis A.

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests/Assignments 40%

**CHEM3011 CHEMICAL ANALYSIS LABORATORY II**  
(2 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2010 - Chemical Analysis A **AND** CHEM2011 - Chemical Analysis Laboratory I *(Pass or Fail but not Fail Absent).*

**Co-requisite:**

CHEM3010 - Chemical Analysis B.

**Course Content:**

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 Skills 25%
* Speaking Exercises 25%
* Laboratory Reports 50%

**CHEM3110 INORGANIC CHEMISTRY B**   
(3 Credits) (Level 3) (Semester 1)

**Pre-requisites:**

CHEM2110 - Inorganic Chemistry A.

**Course Content:**

1. **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.
2. **Main Group Elements:** Hydrogen and its compounds, Oxides and oxyacids. Halogens and halides. Main Group organometallic compounds.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 40%

**CHEM3111 INORGANIC CHEMISTRY LABORATORY II**

(2 Credits) (Level 3) (Semester 1)

**Pre-requisite:**

CHEM2111 - Inorganic Chemistry Laboratory I.

**Co-requisite(s):**

CHEM3312 - Chemistry of Materials **AND/OR** CHEM3112 - The Inorganic Chemistry of Biological Systems.

**Course Content:**

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:**

* In-course Tests 20%
* Written Laboratory Reports 80%

**CHEM3112 THE INORGANIC CHEMISTRY OF BIOLOGICAL SYSTEMS**

(3 Credits) (Level 3) (Semester 1)

**Pre-requisites:**

CHEM2110 - Inorganic Chemistry A **AND** CHEM3110 - Inorganic Chemistry B.

**Course Content:**

Amino acids, peptides and proteins; Metal storage & transport: Fe, Cu, Zn and V.

Molecular dioxygen, O2; Biological redox processes; The Zn2+ ion: Nature’s Lewis acid; Metal complexes used for diagnosis and treatment in medicine.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + Assignment 10%
  + In-course Tests 30%

**CHEM3210 ORGANIC CHEMISTRY B**

(3 Credits) (Level 3) (Semester 2)

**Pre-requisite:**

CHEM2210 - Organic Chemistry A (Pass or Fail but NOT Fail Absent).

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 40%

**CHEM3211 ORGANIC CHEMISTRY LABORATORY II**   
(3 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2211 - Organic Chemistry Laboratory I **AND** permission of Head of Department.

**Co-requisite(s):**

CHEM3212 **-** Natural Products Chemistry **AND/OR** CHEM3213 **-** Applications of Organic Chemistry in Medicine and Agriculture.

**Course Content:**

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 Tests 20%

**CHEM3212 NATURAL PRODUCTS CHEMISTRY**

(3 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2210 - Organic Chemistry A, CHEM3210 - Organic Chemistry A **AND** permission of Head of Department.

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 40%

**CHEM3213 APPLICATIONS OF ORGANIC CHEMISTRY IN MEDICINE AND AGRICULTURE**   
(3 Credits) (Level 3) (Semester 1)

**Pre-requisites:**

CHEM2210 - Organic Chemistry A **AND** CHEM3210 - Organic Chemistry A.

**Course Content:**

1. **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.
2. **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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 40%

**CHEM3310 PHYSICAL CHEMISTRY B**   
(3 Credits) (Level 3) (Semester 2)

**Pre-requisite:**

CHEM2310 - Physical Chemistry A (Pass or Fail but NOT Fail Absent)

**Course Content:**

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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + Written Assignments 10%
  + In-course Tests 30%

**CHEM3311 PHYSICAL CHEMISTRY LABORATORY II**  
(2 Credits) (Level 3) (Semester 1)

**Pre-requisites:**

CHEM2311 - Physical Chemistry Laboratory I **AND** permission of Head of Department.

**Co-requisite(s):**

CHEM3312 - Chemistry of Materials **AND/OR** CHEM3313 - Topics in Advanced Physical chemistry.

**Course Content:**

Polymer viscosity; Surface chemistry micellization; X-ray diffraction; Polymer synthesis and characterization magnetic properties of solutions.

**Evaluation:**

* In-course Tests 20%
* Laboratory Reports 80%

**CHEM3312 CHEMISTRY OF MATERIALS**   
(3 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2310 - Physical Chemistry A **AND** CHEM2110 - Inorganic Chemistry A **AND** permission of Head of Department.

**Course Content:**

1. **Polymers:** definitions, nomenclature, molecular architecture.
2. **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.
3. **The Structure of Solids:** Symmetry in crystals and their diffraction patterns. X-ray Diffraction: the Powder Method versus Single Crystal X-ray Diffraction.
4. **Semiconductors:** properties and types; optical and electrical properties, photoconductivity, luminescence; Applications.
5. **Classification of Nanomaterials:** Synthesis; structure and properties.
6. **Materials Characterisation:** Optical and Electron Microscopy: TEM, SEM; Surface and Bulk Characterisation Techniques.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 20%
  + Assignments 20%

**CHEM3313 TOPICS IN ADVANCED PHYSICAL CHEMISTRY**   
(3 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2310 - Physical Chemistry A **AND** CHEM3310 - Physical Chemistry B.

**Course Content:**

1. **Computational Method**s: Molecular orbital approximations; Molecular conformational energies; Charge distributions; Dipole moments.
2. **Molecular Interactions:** Electric dipole moments; Interaction between dipoles; Hydrogen bonding; Molecular recognition; Kinetic model for the perfect gas; Real gases; Molecular Interactions in liquids.
3. **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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + Written Assignments 10%
  + In-course Tests 30%

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

(4 Credits) (Level 3) (Semester 1)

*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 - Food Processing Principles I **OR** CHEM2512 - Food Processing Principles II **AND** CHEM2511 - Food Processing Laboratory **OR** CHEM3402 - The Chemical Industries **AND** Permission of Head of Department.

**Course Content:**

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

**Evaluation:**

* Final Written Examination (2 hours) 75%
* Course Work: 25%
  + Team-based Project 25%

**CHEM3402 THE CHEMICAL INDUSTRIES**   
(4 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

Any two combinations:

CHEM2010 - Chemical Analysis A **AND** CHEM2011 - Chemical Analysis Laboratory I

**OR**

CHEM2110 - Inorganic Chemistry A **AND** CHEM2111 - Inorganic Chemistry Laboratory I

**OR**

CHEM2210 - Organic Chemistry A **AND** CHEM2211 - Organic Chemistry Laboratory I

**OR**

CHEM2310 - Physical Chemistry A **AND** CHEM2311 - Physical Chemistry Laboratory I

**AND** Permission of Head of Department.

**Course Content:**

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

1. **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.
2. **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.
3. **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.
4. **Cement Manufacture:** Technologies, raw materials and products; Basic cement chemistry; Equipment; Measurement and control of fineness. CaO-SiO2-Al2O3 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:**

* Final Written Examination (2 hours) 50%
* Course Work: 50%
  + Work Placement 25%
  + Assignments 25%

**CHEM3403 CHEMICAL PROCESS PRINCIPLES**   
(8 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2310 - Physical Chemical A and CHEM2311 - Physical Chemistry Laboratory I **AND** Permission of HOD.

**Course Content:**

Process Material Balances; Heat Transfer Operations; Mass Transfer Processes; Applied Thermodynamics and Applied Kinetics; 72 hours of laboratory work.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 20%
  + Practical Work 20%

**CHEM3510 FOOD CHEMISTRY I**   
(3 Credits) (Level 3) (Semester 1)

**Pre-requisites:**

CHEM2010 - Chemical Analysis A **and** CHEM2011 - Chemical Analysis Laboratory I **AND** CHEM2210 - Organic Chemistry A **and** CHEM2211 - Organic Chemistry Laboratory I **AND** Permission of Head of Department.

**Course Content:**

1. **Water:** Properties; water-solute interactions, ice-water interactions; water activity and food stability.
2. **Carbohydrates:** Structure and classification; starch, pectin, cellulose, gums and dietary fiber; effect of carbohydrates on properties of food; chemical reactions of carbohydrates in foods.
3. **Proteins:** Amino acid - structure and properties; proteins - structure and properties; interactions with other food components; effects of processing on protein structure, function and quality.
4. **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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests (*an assignment may be given*) 40%

**CHEM3511 FOOD CHEMISTRY LABORATORY**

(3 Credits) (Level 3) (Semester 2)

**Pre-requisite:**

Permission of Head of Department.

**Co-requisites:**

CHEM3510 - Food Chemistry I **AND** CHEM3512 - Food Chemistry II.

**Course Content:**

Analytical techniques and methodologies commonly used for the analysis of macro and micro food components including: spectrophotometry, polarimetry, titrimetry. 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. Lecture sessions will address topics including research ethics, research methodology, laboratory safety, and good laboratory practices.

**Evaluation:**

* Course Assignment 10%
* Oral Presentation 10%
* Laboratory Skills 30%
* Laboratory Reports 50%

**CHEM3512 FOOD CHEMISTRY II**   
(3 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2010 - Chemical Analysis A and CHEM2011 - Chemical Analysis Laboratory I **AND** CHEM2210 - Organic Chemistry A **and** CHEM2211 - Organic Chemistry Laboratory I **AND** Permission of Head of Department.

**Course Content:**

1. **Enzymes:** Nomenclature; catalysis; deactivation; applications in food processing; enzymes and health.
2. **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.
3. **Pigments and Flavours:** Natural and artificial colourants, dyes and lakes; flavours and flavourings; chemistry and physiology of taste and saporous substances; flavour enhancement.
4. **Food Additives:** Classes and applications; safety considerations.
5. **Toxicants and Allergens:** Sources, properties and chemistry; effects on consumer; effect of processing; measures for elimination or reduction of levels in foods.

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests (*an assignment may be given*) 40%

**CHEM3513 FOOD SAFETY AND** **QUALITY ASSURANCE**   
(3 Credits) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM2510 - Food Processing Principles I **or** CHEM2512 - Food Processing Principles II **AND** CHEM2511 - Food Processing Laboratory **AND** Permission of Head of Department. *Preference will be given to students majoring in Food Chemistry.*

**Course Content:**

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

**Evaluation:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests 20%
  + Assignment 20%

**CHEM3610 MARINE AND FRESHWATER CHEMISTRY**

(3 Credits) (Level 3) (Semester 1)

**Pre-requisites:**

CHEM2010 - Chemical Analysis A **and** CHEM2011 - Chemical Analysis Laboratory I **AND** any one of the following:

CHEM2110 - Inorganic Chemistry A, CHEM2210 - Organic Chemistry A, CHEM2310 - Physical Chemistry A **or** CHEM3010 - Chemical Analysis B. *Preference will be given to students pursuing a major in Environmental*

*Chemistry.*

**Course Content:**

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 CO32-/HCO3-/CO2 (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:**

* Final Written Examination (2 hours) 60%
* Course Work: 40%
  + In-course Tests/Assignments 40%

**CHEM3611 ENVIRONMENTAL CHEMISTRY LABORATORY**

(2 Credits) (Level 3) (Semester 1)

**Co-requisite:**

CHEM3610 - Marine and Freshwater Chemistry **AND** Permission of Head of Department. *Preference will be given to students majoring in Environmental Chemistry.*

**Course Content:**

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 Sidrack 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) (Level 3) (Semester 2)

**Pre-requisites:**

CHEM3610 - Marine and Freshwater Chemistry **AND** Permission of Head of Department. *Preference will be given to students majoring in Environmental Chemistry.*

**Course Content:**

1. **Atmospheric Chemistry:** Atmospheric composition and structure; Atmospheric pollution: Global warming; Acid rain; Photochemical smog; Ozone depletion and global treaties.
2. **Environmental Models, Management and Regulations:** Use of Models in Atmospheric Chemistry, Air pollution and management; Air quality standards and pollution monitoring.
3. **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.
4. **Organic Materials:** Biomolecules, their structure, degradation and impacts; pesticides, herbicides, fungicides and emerging pollutants.

**Evaluation:**

* Final Written Examination (2 hours) 50%
* Course Work: 50%
  + Project 15%
  + Field Trip Report 15%
  + In-course Tests 20%

**CHEM3621 MARINE AND FRESHWATER CHEMISTRY FIELD COURSE**

(2 credits) (Semester 2) (Level 3)

**Pre-requisites:**

CHEM3610 - Marine and Freshwater Chemistry **AND** Permission of Head of Department. *Preference will be given to students majoring in Environmental Chemistry.*

**Course Content:**

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%
* In-course Test 20%
* Field Reports 30%
* Data Interpretation Reports 40%

**CHEM3711 CHEMISTRY UNDERGRADUATE RESEARCH PROJECT**   
(6 Credits) (Level 3) (Semesters 1 & 2 or 2 & 3)

**Pre-requisites:**

Majoring in Chemistry; Completion of all compulsory Level 2 courses and at least 6 credits from Level 3 and Head of Department Approval. It is recommended that in the semester prior to enrolling in this course candidates discuss suitable topics with potential academic supervisors.

**Course Content:**

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%
* Oral Examination 20%
* Research Report 40%