THE UNIVERSITY OF THE WEST INDIES
MONA CAMPUS

FACULTY OF SCIENCE AND TECHNOLOGY

UNDERGRADUATE STUDENT HANDBOOK

2015-2016

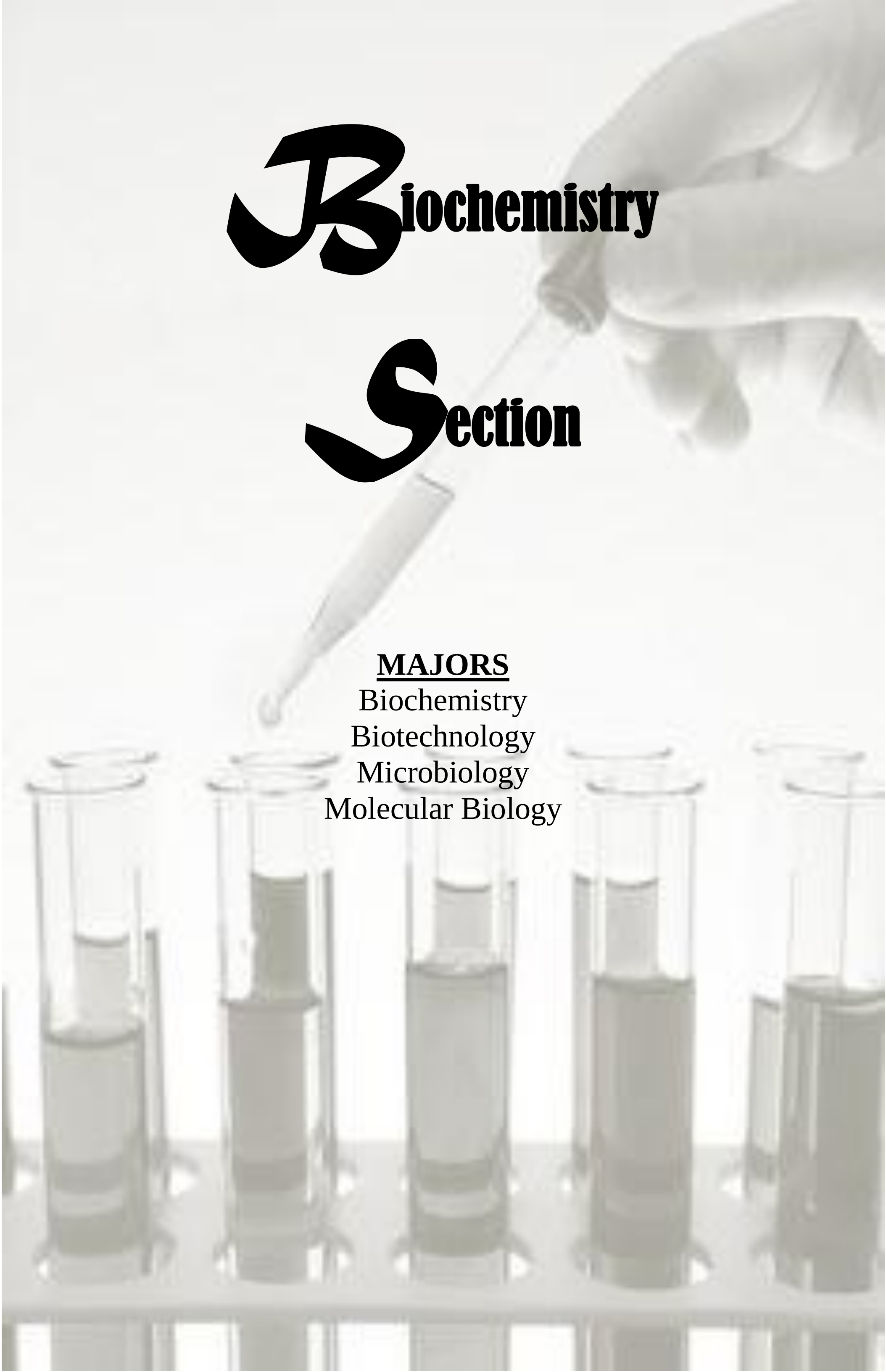
TABLE OF CONTENTS

INTRODUCTION

This Undergraduate Handbook has been compiled to improve the communication between staff and students regarding programmes, that is, the majors, minors and options offered within the Faculty.

The programme requirements outlined are to be adhered to by 1) Students enrolling in the Faculty for the 2015-2016 academic year; 2) Students who transferred into the Faculty for the 2015-2016 academic year; and 3) Students who changed their Major/Minor for the 2015-2016 academic year.

Though the Faculty worked assiduously to present the most updated information in the Handbook, students should communicate with their Departments/Sections for changes that possibly occurred after the publication of the Handbook.



Biochemistry Section

MAJORS

Biochemistry
Biotechnology
Microbiology
Molecular Biology

UNDERGRADUATE COURSES OFFERED BY THE BIOCHEMISTRY SECTION					
CODES	**TITLES**	**CREDIT**	**SEMESTER**	**LEVEL**	**PRE-REQUISITES**
LEVEL 1					
BIOC1020	**Cellular Biochemistry**	**3**	**1 or 2**	**1**	**CAPE Chemistry (1 & 2) and CSEC Biology, or equivalents**
BIOC1021	**Practical Biochemistry I**	**2**	**1 or 2**	**1**	**CAPE Chemistry (1 & 2) and CSEC Biology, or equivalents. Co-requisite: BIOC1020**
MICR1010	**Introductory Microbiology & Molecular Biology**	**3**	**1 or 2**	**1**	**CAPE Chemistry (1 & 2) and CSEC Biology, or equivalents**
MICR1011	**Practical Microbiology and Molecular Biology I**	**2**	**1 or 2**	**1**	**CAPE Chemistry (1 & 2) and CSEC Biology, or equivalents. Co-requisite: MICR1010**
LEVEL 2					
BIOC2020	**Biochemical Reactions**	**3**	**1 or 2**	**2**	**BIOC1020, BIOC1021, MICR1010, MICR1011, CHEM1901 & CHEM1902.**
BIOC2021	**Practical Biochemistry II**	**2**	**1 or 2**	**2**	**BIOC1020, BIOC1021, MICR1010, MICR1011, CHEM1901 & CHEM1902.**
BIOC2022	**General Biochemistry**	**3**	**1 or 2**	**2**	**BIOC1020 & MICR1010**

BIOL2312	**Molecular Biology I (BC21C)**	**4**	**2**	**2**	**BIOC1020, BIOC1021, MICR1010, MICR1011, CHEM1901 & CHEM1902. Co-requisites: BIOC2020, BIOC2021, BIOC2022**
MICR2211	**Microbiology (BC21M)**	**4**	**2**	**2**	**BIOC1020, BIOC1021, MICR1010, MICR1011, CHEM1901 & CHEM1902. Co-requisites: BIOC2020, BIOC2021, BIOC2022**
LEVEL 3					
BIOC3011	**Advanced Biochemistry**	**4**	**2**	**3**	**BIOC2020, BIOC2021, BIOC2022**
BIOC3013	**Biochemical Physiology**	**4**	**1**	**3**	**BIOC2020, BIOC2021, BIOC2022, BIOL2312**
BIOC3014	**Plant Biochemistry**	**4**	**1**	**3**	**BIOC2020, BIOC2021, BIOC2022**
BIOC3413	**Project**	**4**	**1 or 2**	**3**	**BIOC2020, BIOC2021, BIOC2022, BIOL2312, MICR2211 Co-requisites: BIOC3013, BIOC3014, BIOC3311, BIOL3312, BIOL3313, BIOT3113, BIOT3114, BIOT3116, MICR3213 or MICR3214**
BIOL3312	**Molecular Biology II**	**4**	**1**	**3**	**BIOC2020, BIOC2021, BIOC2022, BIOL2312**
BIOL3313	**Human Molecular Biology**	**4**	**2**	**3**	**BIOC2020, BIOC2021, BIOC2022, BIOL2312 Pre/Co-requisite: BIOL3312**

BIOT3113	**Biotechnology I**	**4**	**1**	**3**	**BIOC2020, BIOC2021, BIOC2022, BIOL2312**
BIOT3114	**Biotechnology II**	**4**	**2**	**3**	**BIOC2020, BIOC2021, BIOC2022, BIOL2312** **Pre/Co-requisite: BIOT3313**
BIOT3116	**The Biotechnology of Industrial Ethanol Production**	**4**	**2**	**3**	**BIOC2020, BIOC2021, BIOC2022, MICR2211**
MICR3213	**Applied and Environmental Microbiology**	**4**	**1**	**3**	**MICR2211**
MICR3214	**Molecular Microbiology**	**4**	**1**	**3**	**MICR2211, BIOL2312**
MICR3215	**Food Microbiology and Biotechnology**	**4**	**2**	**3**	**BIOC2020, BIOC2021, BIOC2022, MICR2211**
MICR3216	**Medical Microbiology**	**4**	**2**	**3**	**MICR2211 (BC21M), BIOC2021, BIOC2020, BIOC2022**

MAJOR IN BIOCHEMISTRY

A major in Biochemistry requires a total of thirty-two (32) credits from Level 2 and 3 and must include:

BIOC2020	Biochemical Reactions
BIOC2021	Practical Biochemistry II
BIOC2022	General Biochemistry
BC21C/BIOL2312	Molecular Biology I
BC21M/MICR2211	Microbiology
BC34B/BIOC3011	Advanced Biochemistry
BC34C/BIOL3312	Molecular Biology II
BC35A/BIOC3013	Biochemical Physiology
and	
BC34D/BIOL3313	Human Molecular Biology
or	
BC39P/BIOC3014	Plant Biochemistry.

MAJOR IN BIOTECHNOLOGY

A major in Biotechnology requires a total of thirty-two (32) credits from Level 2and 3 and must include:

BIOC2020	Biochemical Reactions
BIOC2021	Practical Biochemistry II
BIOC2022	General Biochemistry
BC21C/BIOL2312	Molecular Biology I
BC21M/MICR2211	Microbiology
BC35C/BIOT3113	Biotechnology I
BC35D/BIOT3114	Biotechnology II
and	
BC31M/MICR3213	Applied and Environmental Microbiology
or	
BT38B/BOTN3016	Plant Biotechnology
and	
BC35F/BIOT3116	The Biotechnology of Industrial Ethanol Production
or	
MICR3215	Food Microbiology and Biotechnology

MAJOR IN MICROBIOLOGY

A major in Microbiology requires a total of thirty-two (32) credits from Level 2 and 3 and must include:

BIOC2020	Biochemical Reactions
BIOC2021	Practical Biochemistry II
BIOC2022	General Biochemistry
BC21C/BIOL2312	Molecular Biology I
BC21M/MICR2211	Microbiology
BC31M/MICR3213	Applied and Environmental Microbiology
BC34M/MICR3214	Molecular Microbiology
MICR3215	Food Microbiology and Biotechnology
MICR3216	Medical Microbiology

MAJOR IN MOLECULAR BIOLOGY

A major in Molecular Biology requires a total of thirty-two (32) credits from Level 2 and 3 must include:

BIOC2020	Biochemical Reactions
BIOC2021	Practical Biochemistry II
BIOC2022	General Biochemistry
BC21C/BIOL2312	Molecular Biology I
BC21M/MICR2211	Microbiology
BC34C/BIOL3312	Molecular Biology II
BC34D/BIOL3313	Human Molecular Biology
and	
BC34M/MICR3214	Molecular Microbiology
or	
BC35C/BIOT3113	Biotechnology I
and	
BC35D/BIOT3114	Biotechnology II
or	
BL38A/BIOL3017	Virology

All courses include laboratory sessions. Attendance at, and the submission of the relevant report pertaining to all laboratory sessions mounted for each course by the Biochemistry Section (Department of Basic Medical Sciences) are required.

Note: Students doing a major from the Biochemistry Section must also pursue all Level 1 Chemistry courses.

COURSE DESCRIPTION

MICR1010 **INTRODUCTORY MICROBIOLOGY AND MOLECULAR BIOLOGY**

(3 Credits) Level 1 Semester 1 or 2

Pre-requisites: Passes in both units of CAPE (A-level) Chemistry; CSEC Biology, or equivalents

Course Content: This course will introduce students to examples of bacteria, archaea and yeasts and the habitats/environments in which they live. The important structural features of these microorganisms will be outlined; important applications of microbiology and microbial diseases will be discussed. The fine molecular structure of genetic material and the enzymic mechanisms used in replication, gene expression and recombinant DNA technology will be introduced. *A lecture/tutorial course of 39 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests (1-hour each x 20 each) 40%

MICR1011 **PRACTICAL MICROBIOLOGY AND MOLECULAR BIOLOGY I**

(2 Credits) Level 1 Semester 1 or 2

Pre-requisites: CAPE Chemistry and CSEC Biology or equivalents

Co-requisite: MICR1010

Course Content: Through a series of experiments students will isolate individual microorganisms and culture pure colonies. The effects of differing growth conditions on microorganisms will be demonstrated as will methods of killing unwanted microorganisms. Methods of quantifying microorganisms will be compared and discussed. A sample of DNA will be extracted and digested with restriction endonucleases, and the fragments obtained separated by gel electrophoresis. *A laboratory course of 48 hours.*

Evaluation:

- Ten laboratory reports @ 6% each — 60%
- One 2-hours written paper — 40%

BIOC1020 **CELLULAR BIOCHEMISTRY**

(3 Credits) Level 1 Semester 1 or 2

Pre-requisites: CAPE Chemistry and CSEC Biology or equivalents

Co-requisite: None

Course Content: This course covers the following topics:

Cellular Organisation

- The ultrastructures and major physiological and biochemical functions of subcellular organelles.

Cellular Reproduction

- The major molecular events of organisms undergoing mitosis and meiosis; cell cycles and their regulation.

Biomolecular Structure and Functions

- Mono- di- oligo- and polysaccharides; amino acids, peptides and proteins; lipids; nucleotides and nucleic acids.

Biological Membranes

- Composition of membranes; structures and functions of the major types of membrane proteins. Movement of substances across cell membrane; membrane potentials and excitable membranes.

Extracellular Matrices

- Proteins and proteoglycans, cartilage, bone and biomineralisation.

Enzyme Activity

- Mechanisms of enzyme catalysis; an introduction to enzyme kinetics.

Metabolism

- Biochemical oxidation and reduction reactions; major metabolic pathways and their regulation.

Cell Communication

- Basic elements of cell signalling systems. *A lecture/tutorial course of 39 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests (1-hour each x 20% each) 40%

<u>BIOC1021</u> **<u>PRACTICAL BIOCHEMISTRY I</u>**

(2 Credits) Level 1 Semester 1 or 2

Pre-requisites: CAPE Chemistry and CSEC Biology or equivalents.

Co-requisites: BIOC1020

Course Content: This course will introduce students to the proper use and operational limitations of the instruments commonly used in biochemistry laboratories by employing them in a series of practical experiments under expert guidance. Students will also become familiar with the analysis of the data generated by the experiments and correct methods for reporting the data and interpreted results. *A laboratory course of 48 hours.*

Evaluation:

- Ten laboratory reports @ 6% each 60%
- One 2-hours written paper 40%

<u>BIOC2020</u> **<u>BIOCHEMICAL REACTIONS</u>**

(Not Available for 2015-2016)

(2 Credits) Level 2 Semester 1 or 2

Pre-requisites: Level 1 courses in Biochemistry, Microbiology, Molecular Biology (BIOC1020, BIOC1021, MICR1010, MICR1011), and Chemistry (CHEM1901/C10J and CHEM1902/C10K)

Co-requisite: None

Course Content: This course covers the following topics:

Bioenergetics

- Sources of energy available to the biosphere:

mineral and solar e/m radiation. Photon captures molecules and the excitation of photosynthetic pigment electrons. Biological electron transport chains: flavonoids, haems, quinones, cytochouromes and other redox centres, electron sinks; proton pumps. Biochemical thermodynamics and the principles of oxidative and photophosphorylation.

Biochemical Reactions

- The derivation of the Michaelis-Menten Rate Equation from the first principles of chemical reactions kinetics; Briggs-Haldane kinetics. Michaelis-Menten, Lineweaver-Burk and Eadie-Hofstee plots for the determination of enzyme kinetic parameters. Enzyme reaction mechanisms classified by molecularity, international convention for nomenclature, catalytic mechanisms employed by enzymes. Molecular interactions restricted to binding: Scatchard and Hill equations. *A lecture/tutorial course of 39 hours.*

Evaluation:

- One 2-hours written paper — 60%
- Two In-course tests (1-hour each) @ 20% each — 40%

<u>BIOC2021</u> **<u>PRACTICAL BIOCHEMISTRY II</u>**

(Not Available for 2015-2016)

(2 Credits) Level 2 Semester 1 or 2

Pre-requisites: Level 1 courses in Biochemistry, Microbiology, Molecular Biology (BIOC1020, BIOC1021, MICR1010, MICR1011), and Chemistry (CHEM1901/C10J and CHEM1902/C10K)

Co-requisite: BIOC2020

Course Content: The use of spectrophotometers for the transmittance/absorbance continuous monitoring of reactions, the determination of the concentrations of solutes, and the estimation of suspended solids by turbidity. Enzyme assays by spectrophotometry and oxygen electrodes. Liquid chromatographic separations of biomolecules according to charge, hydrodynamic radius and biological affinity. Protein purification using ammonium sulphate precipitation, dialysis, ion exchange, chromatography, gel permeation, chromatography, affinity chromatography and polyacrylamide gel electrophoresis and its main variants. Subcellular fractionation of organelles by differential centrifugation. The use of oxygen electrodes to monitor photosynthetic oxygen evolution and mitochondrial oxygen consumption. *A laboratory course of 48 hours.*

Evaluation:

- Ten laboratory reports @ 6% each — 60%
- One 2-hours written paper — 40%

BIOC2022 — **GENERAL BIOCHEMISTRY**

(Not Available for 2015-2016)

(3 Credits) Level 2 Semester 1 or 2

Pre-requisites: Level 1 courses in Biochemistry, Microbiology, Molecular Biology (BIOC1020, MICR1010)

Co-requisite: None

Course Content: This course covers the following topics:

Metabolic Diversity of Cells

- The environmental extremes of the biosphere and the biochemical challenges faced by cells and life-forms: variations in pH, temperature, pressure, oxygen, electron sources and sinks, electromagnetic radiation.

Carbon Metabolism

- Glucose formation by photosynthesis and gluconeogenesis, sucrose glycogen and starch formation and breakdown; the catabolism of glucose and other sugars: glycolysis and other fermentation routes, the pentose phosphate pathway, the Krebs and glyoxalate cycles. Fatty acyl formation and breakdown, biosynthesis and catabolism of phospholipids, triacylglycerols, sterols, eicosanoids. The integration of carbon metabolism.

Nitrogen Metabolism

- The biochemistry of oxidised nitrogen ions and reduced nitrogen compounds, examples of amino and nucleic acid formation and degradation pathways, recycling and nitrogen balance.

Protein Structures and Functions

- Methods for the determination of polypeptide and protein structure. Secondary structural motifs and their functions. Tertiary and quaternary structures: versatility and stability considerations. *A lecture/tutorial course of 39 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests (1-hour each) @ 20% each 40%

<u>MICR2211/BC21M</u> **<u>MICROBIOLOGY</u>**

(4 Credits) Level 2 Semester 2

Pre-requisites: Level 1 courses in Biochemistry, Microbiology, Molecular Biology (BIOC1020, BIOC1021, MICR1010, MICR1011), and Chemistry (CHEM1901/C10J and CHEM1902/C10K)

Course Content: The purpose and methods of microbial taxonomy and molecular systematics, the identification of organisms obtained in culture and the construction of phylogenetic trees. The major phylotypes of Bacteria and Archaea will each be discussed with respect to their habitats, physiology and cellular structures. Roles in natural ecosystems, applications and other outstanding features will be discussed in instances where particular organisms provide useful examples. *A lecture/tutorial/practical course of 72 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory practical and reports 20%

BIOC3011/BC34B **ADVANCED BIOCHEMISTRY**
(4 Credits) Level 3 Semester 2

Pre-requisites: BIOC2014/BC21D or BIOC2021, BIOC2020 and BIOC2022

Course Content: The role of cell membrane in the life of the cell. Introduction to Proteomics; Ligand binding; Protein folding; Protein-protein interactions. Cell signalling; Signal transduction. Protein crystallization studies and the photosystems. Molecular biology of photosynthesis. Introduction to the large complex secondary metabolites of plants. Toxins from plants. An overview of plant hormones. Post-harvest physiology. *A practical course of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory reports 20%

BIOL3312/BC34C **MOLECULAR BIOLOGY II**
(4 Credits) Level 3 Semester 1

Pre-requisites: BIOL2312/BC21C and BIOC2014/BC21D or BIOC2021, BIOC2020 and BIOC2022

Course Content: Bacteria, eukaryotic and phage genes, genetic maps and mapping, plasmids, transposons. Genetic recombination, genetic exchange, models of recombination. The arrangement of genes, introns, exons, gene clustering, mitochondria and chloroplasts. Mutations and mutagens, base and nucleotide analogues, alkylating agents, intercalating dyes, ionizing radiation, UV, transposon mutagenesis. DNA repair mechanisms, excision repair, SOS repair. Expression and regulation of eukaryotic and prokaryotic genes, control of transcription-operons in bacteria, control of transcription-eukaryotic RNA polymerase eukaryotic, transcription factors, DNA binding proteins, zinc-finger motif. RNA interference. *A practical course of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory reports 20%

<u>BIOL3313/BC34D</u> **<u>HUMAN MOLECULAR BIOLOGY</u>**

(4 Credits) Level 3 Semester 2

Pre-requisites: BIOL2312/BC21C and BIOC2014/(BC21D or BIOC2021, BIOC2020 and BIOC2022

Pre/Co-requisite: BIOL3312/BC34C

Course Content: The molecular basis of the immune response. The biological basis of the HIV-AIDS epidemic. The molecular basis of cancer. Mutations and the role of genetic predisposition in the etiology of both monogenic and multifactorial diseases. Haemoglobinopathies; in-born errors of metabolism. How these genes are inherited and their frequencies among different populations. The concept of 'nature vs. nurture.' The Human Genome Project, the data generated and the practical and ethical implications of this knowledge. The projected role of gene therapy in treatment of genetic diseases. Pharmacogenomics. *A practical course of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory reports 20%

<u>BIOC3013/BC35A</u> **<u>BIOCHEMICAL PHYSIOLOGY</u>**

(4 Credits) Level 3 Semester 1

Pre-requisites: BIOL2312/BC21C and BIOC2014/BC21D or BIOC2021, BIOC2020 and BIOC2022

Course Content: Cellular signalling, endocrinology, the regulation and integration of the metabolic pathways for carbohydrate, lipid and protein metabolism. Organ specialization, macro-nutrient and micro-nutrient nutrition, digestion and absorption. Sugar and fat substitutes; vitamin and mineral utilization by the body; energy expenditure and requirements during feasting, fasting, exercise; nutrient deficiencies; malnutrition and its sequelae; obesity, free radical formation, antioxidants. Clinical chemistry tests. *A practical course of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory reports 20%

BIOC3014/BC39P **PLANT BIOCHEMISTRY**

(4 Credits) Level 3 Semester 2

Pre-requisites: B10C2014/BC21D or BIOC2021, BIOC2020 and BIOC2022

Course Content: The course will consider the chemical constituents of plants, their synthesis, their contribution to key metabolic processes and the regulation of their biosynthesis. Topics will include the biosynthesis and Method of action of phytohormones and their role in development and plant defence; the role of ethylene in fruit ripening; carbohydrates, lipids and nitrogen fixation; plant secondary metabolites, anti-nutritional factors; storage organs and tuberization; and the regulation of gene expression in plants. The course will also provide tools for understanding fundamental features of plant-based research, such as modification of fruit-ripening using controlled atmospheres. Secondary metabolites and their uses. *A practical course of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory reports 20%

BIOT3113/BC35C **BIOTECHNOLOGY I**

(4 Credits) Level 3 Semester 1

Pre-requisites: BIOL2312/BC21C and BIOC2014/BC21D or BIOC2021, BIOC2020 and BIOC2022

Course Content: **Fundamentals of Biotechnology**

- The Biotechnology Revolution. Recombinant DNA technology and methods. Molecular research procedures. Manipulation of gene expression in prokaryotes. Protein production in eukaryotic cells. Site-directed mutagenesis. Protein engineering. Fermentation technology. *A practical course of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory reports 20%

BIOT3114/BC35D **BIOTECHNOLOGY II**

(4 Credits) Level 3 Semester 2

Pre-requisites: BIOL2312/BC21C and BIOC2014/BC21D or BIOC2021, BIOC2020 and BIOC2022

Pre/Co-requisite: BIOT3113/BC35C

Course Content: This course covers the following topics:

Microbial Systems

- Microbial synthesis of pharmaceutical and other commercial products. Molecular diagnostics systems for detecting diseases and transgenic organisms. Vaccines and Therapeutic Agents. Biomass utilization & bioremediation. Plant growth-promoting bacteria. Microbial insecticides.

Eukaryotic Systems

- Development and use of transgenic plants. Development and use of transgenic animals. Isolation of human genes. Human somatic cell gene therapy. *In vitro* regenerative technology & biomaterials for organ regeneration.

Current Issues

- Regulation and patenting of biotechnology products. Biotechnology as a Business current market trends. *A practical course of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20%
- Laboratory reports 20%

BIOT3116 (BC35F) **THE BIOTECHNOLOGY OF INDUSTRIAL ETHANOL PRODUCTION**

(4 Credits) Level 3 Semester 2

Pre-requisites: MICR2211(BC21M) and BIOC2014 (BC21D) or BIOC2021, BIOC2020 and BIOC2022

Course Content: The theory and practice of industrial ethanol production: beers, wines, potable spirits and industrial grade ethanol. Preparation of fermentation feed stocks and media: batch & continuous fermentation systems; fermentor design, instrumentation & control. Biochemical aspects of nutrient utilization. Elementary Process Economics. Product recovery and treatment; waste treatment. The practical component of the course will be fulfilled by site visits to local industrial fermenteries: a brewery, a winery and a distillery; and reports will be submitted thereof, including analysis of specific data supplied on site.

Evaluation:

- One 2-hours written paper 60%
- Two 1-hour In-course tests 20%
- Site-visit reports 20%

BIOC3413 (BC36A) **PROJECT**

(4 Credits) Level 3 Semesters 1 or 2

Pre-requisites: BIOL2312/BC21C and MICR2211/BC21M and BIOC2014/BC21D or BIOC2021, BIOC2020 and BIOC2022

Co-requisites: MICR3213/BC31M, BIOC3011/BC34B, BIOL3312/BC34C, BIOL3313/BC34D, MICR3214/BC34M, BIOC3013/BC35A, BIOT3113/BC35C, BIOT3114/BC35D, BIOT3116/BC35F or BIOC3014/BC39P

Note: This course is available only to final year students majoring in Biochemistry, Biotechnology, Microbiology or Molecular Biology. Entry will be dependent on the student's academic performance to date and available space.

Course Content: Practical research on an approved topic.

Evaluation:

- Project Report 60%
- Seminar presentation 40%

MICR3213 (BC31M) APPLIED AND ENVIRONMENTAL MICROBIOLOGY

(4 Credits) Level 3 Semester 1

Pre-requisite: MICR2211/BC21M

Course Content: Microbial growth kinetics. Effects of chemical bactericides; bacteriolytic and bacteriostatic agents. Antiseptics and disinfection; Microbial adaptation to extreme environments and the use of extreme environments to control microbial growth. Microbial ecology; Waterborne pathogens: Industrial microbiology. *A practical section of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20% (equally weighted)
- Laboratory reports 20% (equally weighted)

MICR3214 (BC34M) MOLECULAR MICROBIOLOGY

(4 Credits) Level 3 Semester 1

Pre-requisites: BIOL2312 (BC21C) and MICR2211 (BC21M)

Course Content: Introduction to molecular microbiology; Health/economic significance of micro-organisms. Culture-based and molecular detection of microorganisms. Microbial interactions: environmental and quorum sensing. Microbe-host interactions. Microbial pathogenicity. Comparative and environmental genomics. *A practical section of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Two In-course tests 20% (equally weighted)
- Laboratory and reports 20% (equally weighted)

MICR3215 **FOOD MICROBIOLOGY AND BIOTECHNOLOGY**

(4 Credits) Level 3 Semester 2

Pre-requisites: MICR2211 (BC21M) and BIOC2014 (BC21D) or BIOC2021, BIOC2020 and BIOC2022
Other qualified students may be admitted by the Head of Department

Course Content: This course will consider how biotechnology exploits microorganisms in the production of foods. The course will review both traditional as well as modern biotechnological inputs in the food processing industry. The biotechnology of enzymes, fats, oils, flavour and recombinant DNA technology used in production of novel food ingredients or new food products will be explored. The course will also cover the main characteristics, diagnosis and control of commonly encountered food-borne pathogens, and the significance of currently important and emerging pathogens. Current issues related to genetically modified foods will also be discussed. A *practical section of 36 hours.*

Evaluation:

- One 2-hours written paper 60%
- Ten Laboratory reports 20% (equally weighted)
- Two In-course tests 20% (equally weighted)

This course will be offered adjacent to BIOT3116 (BC35F) Biotechnology of Ethanol Fermentation, therefore students will have to choose between BIOT3116 and MICR3215.

MICR3216 **MEDICAL MICROBIOLOGY**

(4 Credits) Level 3 Semester 2

Pre-requisites: MICR2211 (BC21M), BIOC2021, BIOC2020, BIOC2022

This course is open to students from Faculties of Science and Technology and Medical Sciences and can be used to satisfy core requirements for Microbiology.

Course Content: This provides the fundamental principles of medical microbiology including the sub-disciplines of bacteriology, virology, mycology, and parasitology. Basic genetic and molecular biological concepts are integrated and connected to clinical manifestations of disease. Students acquire an understanding of the physiological and virulence properties of microorganisms and epidemiological factors contributing to human infectious disease and an introduction to the activities and uses of antimicrobial agents for asepsis and treatment. The course also provides opportunities to develop informatics and diagnostic skills (via cases), including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.

Evaluation:

- One 2-hours written paper 60%
- Laboratory reports (equally weighted) 20%
- Two In-course tests (Each contributes 10%) 20%

Department OF Chemistry

BSc. Degrees

Chemistry and Management
Chemistry with Education
Occupational and Environmental Safety and Health
Special Chemistry

Majors

Applied Chemistry
General Chemistry
Environmental Chemistry
Food Chemistry

Minors

Environmental Chemistry
Food Chemistry
Food Processing
General Chemistry
Industrial Chemistry

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				
CHEM1901	Introductory Chemistry A	6	1	CHEM0901 and CHEM0902, or CAPE Chemistry, or GCE A-level Chemistry
CHEM1902	Introductory Chemistry B	6	2	CHEM0901 and CHEM0902, or CAPE Chemistry OR GCE A-level Chemistry
LEVEL 2				
CHEM2010	Chemical Analysis A	3	1	CHEM1901 and CHEM1902; FOUN1401 or FOUN1001 with HOD approval
CHEM2011	Chemical Analysis Laboratory I	2	1	CHEM1901 and CHEM1902; FOUN1401 or FOUN1001 with HOD approval; (CHEM2010)
CHEM2110	Inorganic Chemistry A	3	2	CHEM1901 and CHEM1902

CHEM2111	**Inorganic Chemistry Laboratory I**	**2**	**2**	**CHEM1901 and CHEM1902 (CHEM2110)**
CHEM2210	**Organic Chemistry A**	**3**	**1**	**CHEM1901 and CHEM1902**
CHEM2211	**Organic Chemistry Laboratory I**	**2**	**1**	**CHEM1901 and CHEM1902 (CHEM2210)**
CHEM2310	**Physical Chemistry A**	**3**	**1**	**CHEM1901 and CHEM1902**
CHEM2311	**Physical Chemistry Laboratory I**	**2**	**2**	**CHEM1901 and CHEM1902 (CHEM2310)**
CHEM2402	**Chemistry In Our Daily Lives**	**3**	**1**	**CHEM1901 and CHEM1902**
CHEM2410	**Water Treatment**	**4**	**1**	**CHEM1901 and CHEM1902 and Permission of HOD**
CHEM2510	**Food Processing Principles I**	**3**	**2**	**CHEM1901 and CHEM1902 and Permission of HOD**
CHEM2511	**Food Processing Laboratory**	**3**	**1**	**CHEM1901 and CHEM1902 and Permission of HOD**
CHEM2512	**Food Processing Principles II**	**3**	**1**	**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)**

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 & 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**
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 + CHEM2511 or CHEM3402**
CHEM3402	**The Chemical Industries**	**4**	**2**	**Any two of CHEM2010+CHEM2011, CHEM2110, CHEM2210+CHEM2211 or CHEM2310; 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**
CHEM3513	**Food Safety & Quality Assurance**	**3**	**2**	**CHEM2510 OR CHEM2512 and Permission of HOD**
CHEM3610	**Marine And Freshwater Chemistry**	**3**	**1**	**CHEM2010, CHEM2011 and any one of the following: CHEM2110, CHEM2210, CHE**

				M231 0 or CHEM3010
CHEM3611	Environmental Chemistry Laboratory	2	1	Permission of HOD; (CHEM3610)
CHEM3612	Atmospheric Chemistry & Biogeochemical Cycles	6	2	CHEM3610; Permission of HOD
CHEM3621	Marine And Freshwater Chemistry Field Course	2	2	CHEM3610; 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

Note:

All Majors and Degrees in Chemistry require Six (6) 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 (6) 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.

MAJOR IN GENERAL CHEMISTRY

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 3, students take 10 credits of core chemistry (inclusive of 4 credits in laboratory courses) and 9 credits in electives.

COURSES REQUIRED FOR MAJOR IN GENERAL CHEMISTRY	
SEMESTER 1	SEMESTER 2
LEVEL 1 : 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 2 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 3 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 3 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 3 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 2/3 credits from listed electives	

LIST OF CHEMISTRY ELECTIVES

CODE	COURSE TITLE	NO. 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

MAJOR IN APPLIED CHEMISTRY

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.

COURSES REQUIRED FOR MAJOR IN APPLIED CHEMISTRY	
SEMESTER I	**SEMESTER II**
YEAR 1: 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. (taken in Semester 1 or Semester 2) (3 credits)
YEAR 2: 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 <u>may</u> be counted as elective credits.	
YEAR 3: 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		
CODE	**COURSE TITLE**	**NO. 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 CHEM3512 CHEM3513	Food Chemistry I Food Chemistry II Food Safety & Quality Assurance	3 3 3
CHEM3621	Marine & Freshwater Chemistry Field Course	2
CHEM3711	Chemistry Undergraduate Research Project	6

MAJOR IN ENVIRONMENTAL CHEMISTRY

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.

COURSES REQUIRED FOR MAJOR IN ENVIRONMENTAL CHEMISTRY	
SEMESTER 1	**SEMESTER 2**
YEAR 1: 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. (taken in Semester 1 or Semester 2) (3 credits)
YEAR 2: 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 3: 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 2 laboratory electives (CHEM2111, CHEM2211 or CHEM2311) are also required.	

ELECTIVES FOR THE ENVIRONMENTAL CHEMISTRY MAJOR		
CODE	**COURSE TITLE**	**NO. 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
GGEO2332	Introduction to Geographic Information Systems	3
PHYS3661	Physics of the Atmosphere and Climate	3
PHYS3671	Solar Power	3
PHYS3681	Wind and Hydro Power	3
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 1 credits in the subject of interest are required. One or more advanced courses may also be needed.		

MAJOR IN FOOD CHEMISTRY

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 1 Chemistry, the Level 2 courses cover central areas of organic and physical chemistry concepts, chemical analysis, water treatment and food processing technologies. At Level 3, 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.

COURSES REQUIRED FOR MAJOR IN FOOD CHEMISTRY	
SEMESTER 1	**SEMESTER 2**
LEVEL 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 Sciences. (taken in Semester 1 or Semester 2) (3 credits)
LEVEL 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)
LEVEL 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)	

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 2 core courses.

COURSES REQUIRED FOR MINOR IN GENERAL CHEMISTRY	
SEMESTER 1	**SEMESTER 2**
LEVEL 1: 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 Structure and Content:
This programme consists of 15 compulsory Advanced (Level 2/Level 3) 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 MINOR IN ENVIRONMENTAL CHEMISTRY	
SEMESTER 1	**SEMESTER 2**
LEVEL 2: 4 required credits	
CHEM2410 – Water Treatment (4 Credits)	
LEVEL 3: 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 Structure and Content:
This programme consists of 16 Advanced (Level 2/Level 3) credits. The required Level 3 courses (9 credits) 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.

ADVANCED COURSES REQUIRED FOR MINOR IN FOOD CHEMSITRY	
SEMESTER 1	**SEMESTER 2**
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 Structure and Content:

This programme consists of 16 Advanced (Level 2/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.

ADVANCED COURSES REQUIRED FOR FOOD PROCESSING MINOR	
SEMESTER 1	**SEMESTER 2**
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 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 REQUIRED FOR MINOR IN INDUSTRIAL CHEMISTRY	
SEMESTER 1	**SEMESTER 2**
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.	

BSc. CHEMISTRY AND MANAGEMENT

Programme Structure and Content:
This programme consists of 65 Advanced (Level 2/Level 3) credits taken from Chemistry courses (32 credits) and Management Studies (33 credits).

<table>
<tr><th colspan="2">COURSES REQUIRED FOR BSc. CHEMISTRY AND MANAGEMENT</th></tr>
<tr><th>SEMESTER 1</th><th>SEMESTER 2</th></tr>
<tr><td colspan="2">LEVEL I : 36 compulsory credits (12 credits of Chemistry courses plus 6 credits of Mathematics plus 18 credits from Management Studies)</td></tr>
<tr><td>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)</td><td>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)</td></tr>
<tr><td></td><td>PSYC1002:Introduction to Industrial and Organizational Psychology (3 credits)
ECON1012:Principles of Economics II (3 credits)</td></tr>
<tr><td colspan="2">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)</td></tr>
<tr><th colspan="2">Level 2 : 41 compulsory credits
(20 credits of Chemistry and 21credits from Management Studies)</th></tr>
<tr><td>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)</td><td>CHEM2110: Inorganic Chemistry A (3 credits)
CHEM2111: Inorganic Chemistry Lab I (2 credits)
CHEM2311: Physical Chemistry Lab I (2 credits)</td></tr>
</table>

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 3: 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)
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 2/3 credits from Chemistry and 3 additional Level 2/Level 3 credits from a Management Studies course

LIST OF CHEMISTRY ELECTIVES

CODE	COURSE TITLE	NO. 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

BSc. CHEMISTRY WITH EDUCATION
(FOR TRAINED AND PRE-TRAINED TEACHERS)

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 2 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.

COURSES REQUIRED FOR BSc. CHEMISTRY WITH EDUCATION					
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 (6)	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 2 or 3	CHEM2010(3) CHEM2011(2) CHEM3110(3)	CHEM2010(3) CHEM2011(2) CHEM2210 (3) CHEM2211(2) CHEM2310 (3) Plus one more Level 2 (3 credits)
	2	Core Education		EDRS3019 (3)	
		Chemistry	3 credits from Level III taken from CHEM3010 (3) **OR** CHEM3310	3 credits from Level 3 taken from CHEM3010 (3) **OR** CHEM3310 (3) Plus an additional 3 credits from Level 2 or 3	CHEM2110 (3) CHEM3010 (3) CHEM3210 (3) CHEM3310 (3) Plus an additional 3 credits from Level 2 or 3
		University Foundation			

LIST OF CHEMISTRY ELECTIVES		
CODE	**COURSE TITLE**	**NO. 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 BSc. Chemistry with Education requires Six (6) 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 (6) 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.*

BSc. SPECIAL DEGREE IN CHEMISTRY

Programme Structure and Content:
The Special Chemistry degree consists of 54 credits of advanced chemistry which build on the 12 credits of broad based Level1 Chemistry and 6 credits of Level I Mathematics. The 40 compulsory Level 2 and Level 3 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 3 laboratory courses in Chemistry, 10 credits in Chemistry electives, and 6 credits from Level 2/3 courses in another science subject or in Mathematics.

COURSES REQUIRED FOR BSc. SPECIAL CHEMISTRY	
SEMESTER 1	**SEMESTER 2**
LEVEL 1 : 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 2 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 3 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 3 credits from	
CHEM3311 – Physical Chemistry Laboratory II (2) CHEM3111 – Inorganic Chemistry Laboratory II (2)	CHEM3211– Organic Chemistry Laboratory II (2)
Plus 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		
CODE	**COURSE TITLE**	**NO. 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

BSc. OCCUPATIONAL AND ENVIRONMENTAL SAFETY AND HEALTH (OESH)

Programme Structure

The programme runs for three (3) years full-time and is divided into two (2) levels. Level 1 consists of seven (7) courses which must be completed in year one, while Levels 2 and 3 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 2 **(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 3 (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)

COURSE DESCRIPTION

CHEM0901 **PRELIMINARY CHEMISTRY A**

(6 P-Credits) Semester 1 Level 0

Pre-requisite: CSEC (CXC) Chemistry Grade 3 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 3 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.

CHEM1901 **INTRODUCTORY CHEMISTRY A**

(6 Credits) Semester 1 Level 1

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 1

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.

CHEM2010 **CHEMICAL ANALYSIS A**

(3 Credits) Semester 1 Level 2

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 2

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 2

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 2

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 2

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 2

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 2

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 2

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 2

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 2

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%

<u>CHEM2511</u> **<u>FOOD PROCESSING LABORATORY</u>**

(3 Credits) Semester 1 Level 2

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%

<u>CHEM2512</u> **<u>FOOD PROCESSING PRINCIPLES II</u>**

(3 Credits) Semester 1 Level 2

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%

<u>CHEM3010</u> **<u>CHEMICAL ANALYSIS B</u>**

(3 Credits) Semester 2 Level 3

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 3

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 3

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 3

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 3

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 3

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 3

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 3

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 3

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 3

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 3

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 3

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 3

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 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.

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 3

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 3

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 3

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 3

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 3

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 3

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 3

Pre-requisites: CHEM2010, CHEM2011 and any one of the following:
CHEM2110, CHEM2210, CHEM2310: or CHEM 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 3

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 3

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

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 3

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) Semesters 1 & 2 or 2 & 3 Level 3

Pre-requisites: Majoring in Chemistry; Completion of all compulsory Level 2 courses and at least 6 credits from Level 3 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:

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

Department OF Computing

<u>BSc.</u>

Computer Studies
Computer Systems Engineering
Information Technology

<u>MAJORS</u>

Computer Science
Software Engineering

UNDERGRADUATE COURSES OFFERED BY THE COMPUTING DEPARTMENT

CODES	TITLES	CREDIT	SEMESTER OFFERED	PREREQUISITES
LEVEL 1				
COMP1126	Introduction to Computing I	3	1 or 2	Any one of the following: CAPE (or A-level) Science subject EC14C, Teacher's College Diploma or Assoc. Degree in Mathematics or Science or Information Technology
COMP1127	Introduction to Computing II	3	1 or 2	Any one of the following: CAPE (or A-level) Science subject EC14C, Teacher's College Diploma or Assoc. Degree in Mathematics or Science or Information Technology
COMP1161	Object-Oriented Programming	3	1 or 2	COMP1126 and COMP1127
COMP1210	Mathematics for Computing	3	1 or 2	CSEC Mathematics
COMP1220	Computing and Society	3	1 or 2	None
LEVEL 2				
COMP2010	Probability and Statistics for Computing	3	1	COMP1210 and either (MATH0110 and MATH0100) or CAPE Mathematics or A-Level Mathematics
COMP2120	Digital Logic Design	3	1	COMP1210
COMP2130	Systems Programming	3	1 or 2	COMP1126, COMP1127 and COMP1161

COMP2140	**Software Engineering**	**3**	**1**	**COMP1126, COMP1127 and COMP1161**
COMP2170	**Object Technology**	**3**	**2**	**COMP2140**
COMP2190	**Net-Centric Computing**	**3**	**1**	**COMP1126, COMP1127, COMP1161, and (COMP1210 or MATH1152) May not be credited with COMP3150(CS32Q)**
COMP2201	**Discrete Mathematics for Computer Science**	**3**	**1**	**COMP1210 or MATH1152**
COMP2211	**Analysis of Algorithms**	**3**	**2**	**COMP1126, COMP1127, COMP1161 and COMP1210**
COMP2340	**Computer Systems Organization**	**3**	**2**	**COMP1126, COMP1127, COMP1161 and COMP1210**
INFO2100	**Mathematics And Statistics For It**	**3**	**2**	**COMP1210**
INFO2110	**Data Structures For IT**	**3**	**1**	**COMP1126, COMP1127 and COMP1161**
INFO2180	**Dynamic Web Development 1**	**3**	**2**	**COMP1126, COMP1127 and COMP1161**
LEVEL 3				
COMP3101	**Operating Systems**	**3**	**1**	**COMP2340**
COMP3161	**Database Management Systems**	**3**	**2**	**COMP1210**
COMP3191	**Principles Of Computer Networking**	**3**	**1**	**COMP2190**
COMP3192	**Implementation Of Computer Networks**	**3**	**2**	**COMP3191**
COMP3220	**Principles Of Artificial Intelligence**	**3**	**1**	**COMP2211 and COMP2201**
COMP3270	**User Interface Design**	**3**	**1 or 2**	**INFO2180 or COMP2140**

COMP3652	**Language Processors**	**3**	**1 or 2**	**COMP2211**
COMP3702	**Theory Of Computation**	**3**	**2**	**COMP2201**
COMP3801	**Real-Time Embedded Systems**	**3**	**1**	**COMP2340 and COMP2140**
COMP3901	**Capstone Project**	**3**	**2 and 3**	**COMP2140, COMP2211, and Any 6 credits of Level 2 or 3 Computing code courses**
COMP3911	**Internship In Computing I**	**3**	**1, 2 or 3**	**Permission of the Head of Department**
COMP3912	**Internship In Computing II**	**6**	**1, 2 or 3**	**Permission of the Head of Department**
INFO3105	**Computer System Administration**	**3**	**1**	**COMP2340 and COMP2190**
INFO3110	**Information Systems**	**3**	**2**	**COMP2140 and COMP2190**
INFO3155	**Information Assurance And Security**	**3**	**2**	**COMP2190 and (COMP2201 or INFO2100)**
INFO3170	**User Interface Design For IT**	**3**	**1**	**COMP2160 or COMP2140 or INFO2180**
INFO3180	**Dynamic Web Development II**	**3**	**1**	**INFO2180**
INFO3435	**Ecommerce**	**3**	**1**	**COMP2140 and INFO2180**
SWEN3130	**Software Project Management**	**3**	**1**	**COMP2140**
SWEN3145	**Software Modeling**	**3**	**1**	**COMP2140 and COMP2170**
SWEN3165	**Software Testing**	**3**	**2**	**COMP2140 and COMP2170**

SWEN3185	**Formal Methods And Software Reliability**	**3**	**2**	**COMP2201**
SWEN3920	**Capstone Project (Software Engineering)**	**6**	**1 , 2 or 3**	**COMP2140, SWEN3130, SWEN3145, SWEN3165 AND SWEN3185**

MAJOR IN COMPUTER SCIENCE

A major in Computer Science requires a minimum of thirty-nine (39) credits from Level 2 and 3 Computer Science courses. The courses that make up the Computer Science major must include the following:

LEVEL 1

COMP1210	Mathematics for Computing
COMP1220	Computing and Society
COMP1126	Introduction to Computing I
COMP1127	Introduction to Computing II
COMP1161	Object-Oriented Programming

LEVEL 2

CS20R/COMP2211	Analysis of Algorithms
CS20S/COMP2201	Discrete Mathematics for Computer Science
COMP2140	Software Engineering
CS23Q/COMP2340	Computer Organization
CS28Q/COMP2170	Object Technology
COMP2190	Net-Centric Computing

LEVEL 3

CS31A/COMP3101	Operating Systems
CS33Q/COMP3220	Introduction to Artificial Intelligence
CS35A/COMP3161	Introduction to Databases
COMP3901	Capstone Project

MAJOR IN SOFTWARE ENGINEERING

A major in Software Engineering requires a minimum of 39 credits from Level 2 and 2 Computing courses. The courses that make up the Software Engineering major must include the following:

LEVEL 1

COMP1126	Introduction to Computing I
COMP1127	Introduction to Computing II
COMP1161	Introduction to Object-Oriented Programming
COMP1210	Mathematics for Computing
COMP1220	Computing and Society

LEVEL 2

COMP2140	Software Engineering
COMP2190	Net-Centric Computing
COMP2201	Discrete Mathematics for Computer Science
COMP2211	Analysis of Algorithms
COMP2170	Object Technology

LEVEL 3

SWEN3130	Software Project Management
SWEN3145	Software Modeling
SWEN3165	Software Testing
SWEN3185	Formal Methods and Software Reliability
SWEN3920	Capstone Project (Software Engineering)
COMP3911	Internship in Computing

BSc. INFORMATION TECHNOLOGY

A B.Sc. in Information Technology requires a minimum of 102 credits as seen below

LEVEL 1 (30 credits)

COMP1126	Introduction to Computing 1
COMP1127	Introduction to Computing II
COMP1161	Object-Oriented Programming
COMP1220	Computing and Society
COMP1210	Mathematics for Computing

Plus twelve (12) credits any discipline three of which must be in-Faculty credits.

LEVEL 2 (15 CREDITS)

INFO2100	Mathematics and Statistics for IT
INFO2110	Data Structures for IT
COMP2140	Software Engineering
INFO2180	Dynamic Web Development 1
COMP2190	Net-Centric Computing

LEVEL 3 (21 CREDITS)

INFO3105	Computer Systems Administration
INFO3110	Information Systems
INFO3155	Information Assurance and Security
COMP3160	Database Management Systems
INFO3170	User Interface Design for IT

INFO3180	Dynamic Web Development II
COMP3901	Capstone Project

- Plus nine (9) credits at Level 2 or level 2 taken from Computing (i.e. CS, IT, SWE, CSE)
- Plus eighteen (18) credits at Level 2 or level 3 taken from any discipline including Computing.
- Plus nine (9) credits of foundational courses

BSc. COMPUTER SYSTEMS ENGINEERING

LEVEL 1 (34 Credits)

ECNG1000	Electrical Circuits
ENGR1000	Introduction to Engineering
COMP1126	Introduction to Computing I
COMP1127	Introduction to Computing II
MATH1180	Engineering Mathematics I
COMP1220	Computing and Society
ECNG1012	Engineering Science and Technology
ELET1400	Introduction to Electronics
ELET1405	Practices in basic Electronics
ELNG1101	Physics for Engineers
COMP1161	Object-Oriented Programming

LEVEL 2 (33 Credits)

ELET2405	Practices in Electronics Designs I
ELET2430	Digital Circuits and Microprocessors
ELET2450	Embedded Systems
COMP2190	Net-Centric Computing
COMP2201	Discrete Mathematics for Computer Science
COMP2140	Software Engineering
INFO2180	Dynamic Web Development I
COMP2211	Analysis of Algorithms
MATH 2201	Probability and Statistics for Engineers
COMP2130	Systems Programming

Semester 3/Summer (3 Credits)

COMP3911	Internship in Computing I

LEVEL 3 (28 credits)
(Students taking Level 3 courses must register for all core courses and any two electives)
Semester 1
Core Courses (13 Credits)

ELET2460	Signals and Systems
COMP3100	Operating Systems
COMP3191	Principles of Computer Networking
ECNG3021	Introduction to Engineering Management and Accounting Systems

Electives

INFO3155	Information Assurance and Security
ELET3485	Introduction to Robotics

Semester 2
Core Courses (9 Credits)

COMP3801	Real Time Embedded Systems
COMP3901	Capstone Project
MGMG3136	New Venture Creation and Entrepreneurship

Electives

ECNG3016	Advanced Digital Electronics
MATH2230	Engineering Mathematics 2

COMPUTER STUDIES OPTION

The Computer Studies Option is defined as indicated below.

LEVEL 1

COMP1210/1220	Math for Computing/Computing & Society
COMP1126/1127	Introduction to Computing (I)/(II)
COMP1161	Object-Oriented Programming
MATH1141/1142	Algebra/Calculus (I)
MATH1151/1152	Formal Mathematics/Calculus (II)
EC10C/ECON1001	Introduction to Microeconomics
EC10E/ECON1002	Introduction to Macroeconomics

Either

MS15D/ACCT1005	Financial Accounting
MS15B/ACCT1003	Introduction to Cost and Management Accounting
or	
SY14/SOCI1002	Sociology for the Caribbean

PS10C/PSYC1002	Introduction to Industrial and Organizational Psychology

LEVEL 2

COMP2211	Analysis of Algorithms
COMP2201	Discrete Mathematics for Computer Science
COMP2140	Software Engineering
COMP2170	Object Technology
COMP2190	Net-Centric Computing
COMP2340	Computer Systems Organization
COMP3101	Operating Systems
COMP3220	Principles of Artificial Intelligence
COMP3161	Database Management Systems
INFO3110	Information Systems
COMP3901	Capstone Project

Plus

Twenty seven (27) additional credits from Level 2 or 3 chosen from Computing, Mathematics, Economics or Management Studies.

COURSE DESCRIPTION

Title:	**<u>INTRODUCTION TO COMPUTING I</u>**
Course Code:	**COMP1126**
Credits:	**3**
Level:	**1**
Semester:	**1 or 2**
Pre-requisite:	Any one of the following: • A CAPE (or A-level) Science subject • EC14C • Teacher's College Diploma or Assoc. Degree in Mathematics or Science or Information Technology

Course Content:

- History of programming languages. Brief survey of programming paradigms
- Building Abstractions

  Computational Processes
  - Primitive Operations
  - Special Forms for naming, conditional execution
  - Procedures as sequences of operations
  - Recursion and Iteration
  - Lexical scoping and Nested Procedures

  Higher-order procedures
  - Customising Procedures with procedural arguments
  - Creating new functions at run-time

  Compound Data: Pairs and Lists

Evaluation:

Final Exam (2 hours long) 60%

Coursework: 40%

- 1 Written assignment/ programming project 15%
- 1 In-course test (1 hr) 10%
- 5 Labs 10%
- 1 Quiz 5%

Title: **INTRODUCTION TO COMPUTING II**
Course Code: **COMP1127**
Credits: **3**
Level: **1**
Semester: **1 or 2**
Pre-requisite: Any one of the following: A CAPE (or A-level Science subject, EC14C, Teacher's College Diploma or Assoc. Degree in Mathematics or Science or Information Technology

Course Content:

- **Building Abstractions**
  - Compound Data: Lists and Trees
  - Abstract Data Types
- **Controlling Interactions**
  - Generic operations
  - Self-Describing Data
  - Message Passing
  - Streams and Infinite Data Structures
  - Object-oriented Programming

Evaluation:

Final Exam (2 hours long)	60%
Coursework:	40%

• 1 written assignment/ programming project	15%
• 1 in-course test (1 hr)	10%
• 5 labs	10%
• 2 quizzes	5%

Title: **OBJECT-ORIENTED PROGRAMMING**
Course Code: **COMP1161**
Credits: **3**
Level: **1**
Semester: **1 or 2**
Pre-requisites: **COMP1126 & COMP1127**

Course Content:
Object-Oriented Programming

- Objects and classes. Methods, message passing. Instance and class variables.
- Encapsulation and information-hiding.

- Imperative control structures, assignment/state, parameter passing models. Primitive types.
- Inheritance, polymorphism, class hierarchies. Object composition.
- Abstract and concrete classes, interfaces. Templates.
- Using APIs, class libraries. Modules/packages.
- Array and string processing. I/O processing.
- Concept of object references and aliases.
- Collection classes and Iterators.
- OO Testing. Debugging tools.

Graphics and GUI Programming, Web Concepts and Objects

- Introduction to GUI programming. Event-driven programming. Exception handling.
- Use of simple graphical libraries, and simple animation programming.
- Simple HTML-embedded objects such as applets.

Evaluation:

2-hour written final	50%	
Coursework:	50%	
• 3 Projects		30% (10% each)
• 3 Labs		5%
• 2 In-course tests (1 hr each)		15% (5% & 10%)

Title:	**MATHEMATICS FOR COMPUTING**
Course Code:	**COMP1210**
Credits:	**3**
Level:	**1**
Semester:	**1 or 2**
Pre-requisite:	**CSEC Mathematics**

Course Content:

- Propositional logic
- Logical connectives
- Truth tables
- Normal forms (conjunctive and disjunctive)
- Validity
- Predicate logic
- Universal and existential quantification
- Modus ponens and modus tollens
- Limitations of predicate logic
- Functions (surjections, injections, inverses, composition)
- Relations (reflexivity, symmetry, transitivity, equivalence relations)

- Sets (Venn diagrams, complements, Cartesian products, power sets)
- Pigeonhole principle
- Cardinality and countability
- Finite probability space, probability measure, events
- Conditional probability, independence
- Trees
- Undirected graphs
- Directed graphs
- Spanning trees/forests

Evaluation:

Final Exam (2 hours)	60%
Coursework	40%
• 3 Assignments/quizzes	30% (10% each)
• 1 In-course test (1 hour)	10%

Title:	**<u>COMPUTING AND SOCIETY</u>**
Course Code:	**COMP1220**
Credits:	**3**
Level:	**1**
Semester:	**1 or 2**
Pre-requisite:	**None**

Course Content:

History of Computing

- History of computer hardware, software, networking. Regional computing history.
- Pioneers of computing. Contributions of region and of other developing countries.

An Overview of Computing

- How hardware, software, and networks work at a conceptual level; use and high-level construction of computing artefacts, e.g. simple webpages, animations, robotics programs.
- Sub-disciplines within Computing: Computer Science, IT, IS, etc.
- The global computing industry and its impact on industry and society.
- The use of computing in enterprise, entrepreneurship, various disciplines and careers.

Social Context of Computing

- Social implications of computing and networked communication in general and on youth, e.g. cultural, self-image, possible effects of videogames
- Understanding the social and cultural context of design

- Understanding the potential of computing to transform society positively, globally or regionally, or to exacerbate inequalities or mask underdevelopment.
- Analysis of the government and business policies of developing and developed countries with successful computing industries.
- Accessibility issues in computing professions (e.g. class, culture, ethnicity, gender, disabled)
- Public policy issues (e.g. cyber-crime, privacy, electronic voting)
- Growth and control of and access to the Internet
- Environmental Issues and Computing, e.g. e-waste, green computing

Professional Ethics in Computing

- Making and evaluating ethical choices and arguments, identifying assumptions and values
- The nature of professionalism (including care, attention and discipline, fiduciary responsibility, and mentoring)
- Keeping up-to-date as a professional (in terms of knowledge, tools, skills, legal and professional framework as well as the ability to self-assess and computer fluency)
- Various forms of professional credentialing and the advantages and disadvantages
- The role of the professional in public policy
- Maintaining awareness of consequences of decisions
- Introduction to ethics, ethical dissent and whistle-blowing
- Codes of ethics, conduct, and practice (IEEE, ACM, SE, and so forth)
- Harassment and discrimination, "Acceptable use" policies for computing in the workplace
- Healthy computing environment (ergonomics)

Risks of Computing Products

- Historical examples of software risks (such as the Therac-25 case)
- Implications of software complexity on risk. The limits of computing.

Evaluation:

2-hour written final	50%
Coursework:	50%
• 3 Written assignments	30% (10% each)
• 2 Tutorial presentations	20% (10% each)

Title:	**PROBABILITY AND STATISTICS FOR COMPUTING**
Course Code:	**COMP2010**
Credits:	**3**
Level:	**2**
Semester:	**1**
Pre-requisites:	**COMP1210 and either (MATH0110 and MATH0100) or CAPE Mathematics or A-Level Mathematics**

Course Content:

- **Discrete probability**
  - Randomness, finite probability space, probability measure, events
  - Conditional probability, independence, Bayes' theorem
  - Discrete random variables, expectation
  - Binomial, Poisson, and geometric distributions
  - Mean and variance: significance, computations, applications
  - Integer random variables
- **Continuous probability**
  - Continuous random variables, the nature of these, illustrations of use
  - Exponential and Gaussian distribution: probability density functions, calculation of mean and variance
  - The central limit theorem and the implications for the normal distribution
- **Expectation**
  - Moments, transform methods, mean time to failure
  - Conditional expectation, examples
  - Imperfect fault coverage and reliability
- **Stochastic processes**
  - Introduction: Bernoulli and Poisson processes, renewal process, renewal model of program behaviour
  - Discrete parameter Markov chains: transition probabilities, limiting distributions
  - Queuing: M/M/1 and M/G/1, birth and death process
  - Finite Markov chains, program execution times
- **Sampling distributions**
  - Purpose and nature of sampling, its uses and applications
  - Random approaches to sampling: basic method, stratified sampling and variants thereof, cluster sampling

    - Non-random approaches: purposive methods, sequential sampling
    - Data analysis; tools; graphical and numerical summaries
    - Multivariate distributions, independent random variables
- **Estimation**
    - Nature of estimates: point estimates, interval estimates
    - Criteria to be applied to single point estimators: unbiased estimators, efficiency and sufficiency of estimators.
    - Maximum likelihood principle approach, least squares approach; applicability conditions for these.
    - Confidence intervals
    - Estimates for one or two samples
- **Hypothesis tests**
    - Development of models and associated hypotheses, the nature of these
    - Formulation of hypotheses: null and alternate hypothesis
    - Testing hypothesis based on a single parameter, choice of test statistic; choice of samples and distributions
    - Criteria for acceptance of hypotheses, significance levels
    - t-test, z-test, Chi-square test, and their applicability
- Correlation and regression
    - Definition and calculation of correlation coefficients
    - Approaches to correlation: the linear model approach, the least squares fitting approach, strengths and weaknesses of these and conditions for applicability

Evaluation:

Coursework:	50%	
• In-course test		10%
• Six (6) assessed tutorials		30%
• Five (5) quizzes		10%
Final written examination (2 hours)	50%	

Title:	**<u>DIGITAL LOGIC DESIGN</u>**
Course Code:	**COMP2120**
Credits:	**3**
Level:	**2**
Semester:	**1**
Pre-requisite:	**COMP1210**

Course Content:

- Boolean Algebra and basic logic circuits
- Optimized implementations
- Representation of numeric data
- Binary arithmetic circuits
- Range, precision, and errors in floating-point arithmetic
- Common combinational circuits
- Flip-flops, registers, and counters
- Finite state machines
- Representation of text, audio, and images
- Data compression

Evaluation:

The coursework will consist of an hour-long in-course exam, ten assessed labs where students will have to write-up their findings from the previous week's lab, and five assessed tutorials. The assessed tutorials are designed to ensure that students develop problem-solving skills. In the assessed tutorials, students will be given tutorial problems that would be collected and marked.

Coursework:	50%	
• In-course exam, 1-hour long		10%
• Five (5) assessed tutorials		10%
• Ten (10) assessed labs		30%
Final written examination (2 hours)	50%	

Title: **SYSTEMS PROGRAMMING**
Course Code: **COMP2130**
Credits: **3**
Level: **2**
Semester: **1 or 2**
Pre-requisites: **COMP1126, COMP1127 and COMP1161**

Course Content:

- **Introduction to computer systems and UNIX development tools.**
    - C Basics, UNIX development tool (gcc, gdb)
    - Using system libraries.
    - Bits, bytes, and bitwise operators.
    - Data structure and object implementation in C and C++.
    - C pointers and arrays, C strings, malloc, realloc, and free as raw memory allocators
    - Linked structures in C, C++.
    - Data type and polymorphism, the void *, function pointers, and generic functions.
    - Floating point representation.
- **Assembly code**
    - Introduction to IA32, ALU operations, addressing, arithmetic, opcodes.
    - Using gcc to generate your compilation product.
    - Analysing compiled programs with gdb to understand the layout of data, functions, function calls, parameters, dynamic memory, etc.
    - Control function calls, runtime stack, passing by value and by address.
    - C++ methods, the this pointer, references, RTTI, runtime and memory model for C++ objects and methods.
    - Calling service routines
- **Memory layout, synthesis, and execution of a UNIX process.**
    - Address spaces, implementations of malloc, realloc, and free.
    - The compilation tool chain, linkers, loaders, and address space.
    - Memory hierarchies, caches, locality, and pipelining.
    - Programming for optimal use of caches and virtual memory.
    - Writing simple optimised code, using gdb and profilers to analyse simple optimised compile programs.
    - Heap allocation, implementation, and garbage collectors.
- **Foreign function calls, e.g., Java Native Interface (JNI)**

Evaluation:

The coursework will consist of an hour-long in-course exam, ten assessed laboratory exercises, and five assessed tutorials. The laboratory exercises are designed for students to practice the programming concepts taught in lecture. In the assessed laboratory exercises students will have to complete a series of programming exercises in a two-hour time slot and demonstrate working programs to a marker. The assessed tutorials are designed to ensure that students develop problem-solving skills. In the assessed tutorials, students will be given tutorial problems that would be collected and marked.

Coursework:	50%	
• In-course exam, 1-hour long		10%
• Ten (10) assessed laboratory exercises		10%
• Five (5) assessed tutorials		5%
• Three (3) programming exercises		25%
Final written examination (2 hours)	50%	

Title:	**<u>SOFTWARE ENGINEERING</u>**
Course Code:	**COMP2140**
Credits:	**3**
Level:	**2**
Semester:	**I**
Pre-requisites:	**COMP1126, COMP1127 and COMP1161**

Course Content:

- **Software Design**
    - Fundamental design concepts and principles
    - The role and the use of contracts
    - Structured design
    - Design qualities
        - Internal - including low coupling, high cohesion, information hiding, efficiency
        - External - including reliability, maintainability, usability, performance
- **Using APIs**
    - Programming using APIs
- **Tools and Environments**
    - Programming environments
    - Requirements analysis and design modelling tools
    - Testing tools including static and dynamic analysis tools
    - Tools for source control, and their use in particular in team-work

    - Configuration management and version control tools
    - Tool integration mechanisms
- **Software Processes**
    - Software life-cycle and process models
    - Software process capability maturity models
    - Approaches to process improvement
    - Process assessment models
    - Software process measurements
- **Requirements Specifications**
    - Systems level considerations
    - Software requirements elicitation
    - Requirements analysis modelling techniques
    - Functional and non-functional requirements
    - Acceptability of certainty / uncertainty considerations regarding software / system behaviour
    - Prototyping
- **Software Verification Validation**
    - Distinguishing between verification and validation
    - Static approaches and dynamic approaches
    - Validation planning; documentation for validation
    - Different kinds of testing – human computer interface, usability, reliability, security, conformant to specification
    - Testing fundamentals, including test plan creation and test case generation black-box and white-box testing techniques
    - Defect seeding
    - Unit, integration, validation, and system testing
    - Measurements: process, design, program
    - Verification and validation of non-code (documentation, help files, training materials)
    - Fault logging, fault tracking and technical support for such activities
    - Regression testing
    - Inspections, reviews, audits
- **Software Evolution**
    - Software maintenance
    - Characteristics of maintainable software
    - Reengineering Legacy systems
    - Refactoring
- **SE/Software Project Management**
    - Team management
        - Team processes
        - Team organization and decision-making

        - Roles and responsibilities in a software team
        - Role identification and assignment
        - Project tracking
        - Team problem resolution
    - Project scheduling
    - Software measurement and estimation techniques
    - Risk analysis
        - The issue of security
        - High integrity systems, safety critical systems
        - The role of risk in the life cycle
    - Software quality assurance
        - The role of measurements
    - Software configuration management and version control; release management
    - Project management tools
    - Software process models and process measurements
- **Professional Ethics**
    - Community values and the laws by which we live
    - The nature of professionalism (including care, attention and discipline, fiduciary responsibility, and mentoring)
    - Keeping up-to-date as a professional (in terms of knowledge, tools, skills, legal and professional framework as well as the ability to self-assess and computer fluency)
    - Various forms of professional credentialing and the advantages and disadvantages
    - The role of the professional in public policy
    - Maintaining awareness of consequences
    - Ethical dissent and whistle-blowing
    - Codes of ethics, conduct, and practice (IEEE, ACM, SE, AITP, and so forth)
    - Dealing with harassment and discrimination
    - "Acceptable use" policies for computing in the workplace
    - Healthy computing environment (ergonomics)
- **Risks**
    - Historical examples of software risks (such as the Therac-25 case)
    - Implications of software complexity
    - Risk assessment and risk management; risk removal, risk reduction and risk control
    -

Evaluation:

Final written examination (2 hours)	40%
Coursework:	60%
One software development group project	
• Requirements Documentation	15%
• Design model (e.g., UML diagrams)	15%
	15%
• Presentations (10) using relevant tools, e.g.PowerPoint	15%
• Final presentation of implemented system	

Title: **<u>OBJECT TECHNOLOGY</u>**
Course Code: **COMP2170**
Credits: **3**
Level: **2**
Semester: **2**
Pre-requisite: **COMP2140**

Course Content:

- **Basic concepts of Object Technology**
  - Encapsulation
  - Information hiding
  - Inheritance
  - Composition
  - Polymorphism
- **Software Design with and for reuse**
  - Object-oriented analysis and design
  - Design patterns (includes architectural patterns)
  - Component-level design
  - Design for reuse
  - Reference software architectures
  - Aspect oriented, Service oriented and agile approaches
  - Use of open-source materials
- **Component-based software development**
  - Building components with/for reuse
  - Provides/requires interfaces
  - Component assembly
- **Building APIs**
  - Design of APIs
  - Class browsers and related tools

- **Formal Specifications**
    - Basic concepts of formal specification techniques
- **Component-based software testing**
    - Black-box, grey-box and white-box testing techniques
    - Object-Oriented testing
    - Component testing
- **Wrapping as a means of converting systems into components**
    - Design, build and use wrappers

Evaluation:

Final written examination (2 hours)	40%
Coursework:	60%
One software development group project	
• Requirements Documentation	15%
• Design model (e.g., UML	15%
diagrams)	15%
• Presentations (10) using relevant	
tools, e.g.PowerPoint	15%
• Final presentation of implemented system	

Title:	**<u>NET CENTRIC COMPUTING</u>**
Course Code:	**COMP2190**
Credits:	**3**
Level:	**2**
Semester:	**2**
Pre-requisites:	**COMP1126, COMP1127, COMP1161, and (COMP1210 or MATH1152) May not be credited with COMP3150(CS32Q)**

Course Content:

- **Introduction**
    - Background and history of network and the Internet
    - Network architectures
    - Networks and protocols
    - Client/server and peer-to-peer paradigms
    - Mobile and wireless computing
- **Network Communication**
    - Network standards and standardization bodies
    - The ISO 7-layer reference model in general and its instantiation in TCP/IP.

    - Overview of physical and data link layer concepts (framing, error control, flow control, and protocols)
    - Data link layer access control concepts.
    - Internetworking and routing (routing algorithms, internetworking, and congestion control).
    - Transport layer services (connection establishment, performance issues, flow and error control).
    - Web protocols with particular emphasis on HTTP.
- **Distributed Computing**
- **Network Security**
    - Fundamentals of cryptography
        - Secret-key algorithms
        - Public-key algorithms
    - Authentication protocols
    - Network attack types, e.g., denial of service, flooding, sniffing, and traffic redirection.
    - Basic network defence tools and strategies
        - Intrusion detection
        - Firewalls
        - Detection of malware
        - Kerberos
        - IPSec
        - Virtual Private Networks
        - Network Address Translation
- **Web Technologies**
    - Basic server-side programs (php, MySQL)
    - Basic client-side scripts (XHTML, XML, JavaScript, CSS)
    - Nature of the client-server relationship
    - Support tools for Web site creation and Web management

Evaluation:

The coursework will consist of an in-course examination, quizzes, written assignments, and individual projects. The in-course examination and quizzes are designed for students to test themselves on the course throughout the semester. The quizzes will be administered through a course management system, e.g., Moodle, and will come at the end of every unit in the course. The written assignments are designed for students to develop problem-solving skills by applying knowledge from the course to a real problem. The projects are designed for students to demonstrate an understanding of the concepts taught in lectures by building a simple system that implements a networking principle.

Coursework:	50%	
• In-course examination (1 hour)		10%
• Quizzes (7)		5%
• Assignments (2)		10%

- Projects (2) 25%

Final written examination (2 hours) 50%

Title:	**DISCRETE MATHEMATICS FORCOMPUTER SCIENCE**
Course title:	**COMP2201**
Credits:	**3**
Level:	**2**
Semester	**1**
Pre-requisite:	**COMP1210 or MATH1152**

Course Content:

- **Basics of Counting**
  - Arithmetic and geometric progressions
  - Fibonacci numbers
  - The pigeonhole principle
  - Basic definitions
  - Pascal's identity
  - The binomial theorem
  - The Master theorem
- **Asymptotic Analysis**
  - Limits
  - Orders of Growth (Big- oh O, Omega Ω and Theta Θ)
- **Graph Theory**
  - Trees
  - Planarity
  - Eulerian and Hamiltonian Cycles
  - Matching and Colouring
- **Elementary Probability Theory**
  - Counting in event space
  - Probability Tree
  - Probability distributions
  - Finite probability space, probability measure, events
  - Conditional probability, independence, Bayes' theorem
  - Integer random variables, expectation
  - Law of large numbers
- **Generating Functions**
  - Convergence Properties
  - Convolution
  - Applications

- **Recurrence Relations**
- Introduction to Automata, Grammars and Languages
  - Finite-state machines
  - Context-free grammars
  - Language type classification and grammar type

Evaluation:

- Coursework: 40%
  - Four assessed homework assignments 20%
  - Two quizzes 5%
  - In-course test (1 hour) 15%
- Final Written Examination (2 hours) 60%

Title: **ANALYSIS OF ALGORI THMS**

Course Code: **COMP2211**

Credits: **3**

Level: **2**

Semester: **2**

Pre-requisites: **COMP1126, COMP1127 and COMP1161 and COMP1210**

Course Content:

- Analysing algorithms: solving recurrence equations with the Mast erTheorem
- Algorithm strategies: brute-force, greedy, divide and conquer, branch-and-bound, heuristic
- Iterated approximations: Newton=Raphson method, searching for ro ots of a polynomial (in one variable).
- Fast exponentiation, Euclid’s algorithm, Discrete logarithm, RSAcr yptography
- Heaps as implementations for priority queues
- Sorting
- Binary search trees, Red-Black trees
- Hashing
- Graphs and graph algorithms
- Distributed computing (introduction): consensus vs. election algor ithms.
- NP-completeness (tractable vs intractable problems)
- Basic computability: uncomputable functions, the halting problem implicates of uncomputability.

Evaluation:

- Coursework: 50%
    - One (1) in-course examination 10%
    - Three (3) written homework assignments 40%
- Final Written Examination (2 hours) 50%

Title:	**<u>COMPUTER SYSTEMS ORGANIZATION</u>**
Course Code:	**COMP2340**
Credits:	**3**
Level:	**2**
Semester:	**2**
Prerequisite:	**COMP1126, COMP1127, COMP1161 and COMP1210**

Course Content:

- **Data Representation and Digital Logic**
    - Overview of the history of the digital computer
    - Introduction to digital logic (logic gates, flip-flops, circuits)
    - Representation of numeric data (floating point)
    - Range, precision, and errors in floating-point arithmetic
    - Characters, pointers, strings, composite data (arrays, lists, objects)
- **The Microarchitecture Level**
    - The functional units of the processor (adders, ALU's, registers, buses)
    - Data paths, microinstructions, the control unit
    - Hardwired controllers and micro-coded controllers
- **Instruction Set Architectures**
    - Introduction to instruction set architecture, microarchitecture and system architecture
    - Processor architecture – instruction types, register sets, addressing modes
    - Processor structures – memory-to-register and load/store architectures
    - Instruction sequencing, flow-of-control, subroutine call and return mechanisms
    - Structure of machine-level programs
    - Limitations of low-level architectures
    - Low-level architectural support for high-level languages
    - Translation (compiling, assembling, linking, loading)
- **Peripherals and Protocols**
    - I/O fundamentals: handshaking and buffering; polling
    - Interrupt mechanisms: vectored and prioritized, interrupt acknowledgment
    - Buses: protocols, arbitration, direct-memory access (DMA)

- Examples of modern buses: e.g., PCIe, USB, Hypertransport
- **Memory**
  - Storage systems and their technology (semiconductor, magnetic, optical)
  - Memory hierarchy, latency and throughput
  - Cache memories: operating principles, replacement policies, multilevel cache, cache coherency
  - Storage standards (CD-ROM, DVD)
  - Sound and audio, image and graphics, animation and video
  - Multimedia standards (audio, music, graphics, image, telephony, video, TV)
  - The significance of power dissipation and its effects on computing structures
- **Input/Output Devices**
  - Input devices: mice, keyboards (text and musical), scanners, touch-screen, voice
  - Video displays and printers
  - Input transducers (temperature, pressure, position, movement)
- **Parallelism**
  - Processor and system performance measures and their limitations
  - Instruction pipelining and instruction-level parallelism (ILP)
  - Superscalar architectures; vector processors; array processors; VLIW
  - Multicore and multithreaded processors
  - GPU's and special-purpose graphics processors
  - Flynn's taxonomy: Multiprocessor structures and architectures
  - Amdahl's law

Evaluation:

Final Written Examination (2 hours)		50%
Coursework		50%
• Assignments (2)	20%	
• In-Course Test (1)	10%	
• Labs (6)	15%	
• Quizzes (5)	5%	

Title: **MATHEMATICS AND STATISTICS FOR IT**
Course Code: **INFO2100**
Credits: **3**
Level: **2**
Semester: **2**
Pre-requisite: **COMP1210**

Course Content:

- Describe the difference between stochastic and deterministic analysis.
- Explain the purpose and nature of statistical sampling.
- Distinguish between the concepts of mean, median and mode, and discuss the drawbacks of each as a descriptive statistic.
- Calculate the mean, median and mode of a given sample of data.
- Calculate the standard deviation of a given sample of data.
- Explain, with examples, the role of probability and statistics in IT.
- Perform a statistical analysis of a system's performance.
- Analyze a statistical analysis of a system's performance and recommend ways to improve performance.
- Randomness, finite probability space, probability measure, events
- Conditional probability, independence, Bayes' theorem
- Integer random variables, expectation
- Formulation of hypotheses: null and alternate hypothesis
- Parametric and non-parametric tests and their applicability
- Criteria for acceptance of hypotheses, significance levels
- t-test, z-test, Chi-square test, and their applicability
- Correlation coefficients
- Linear and nonlinear regression models
- Stochastic versus deterministic analysis
- Purpose and nature of sampling, its uses and applications
- Mean, median, mode, variance, standard deviation

Evaluation:

- Final Exam (2 hr long) 60%
- Coursework: 40%
    - 3 Assignments/quizzes 30% (10% each)
    - 1 In-course test (1 hr) 10%

Title: **DATA STRUCTURES FOR IT**
Course Code: **INFO2110**
Credits: **3**
Level: **2**
Semester: **1**
Pre-requisite: **COMP1126, COMP1127 AND COMP1161**

Course Content:
- Primitive types
- Arrays
- Records
- Strings and string processing
- Data representation in memory
- Pointers and references
- Linked structures
- Knowledge of hashing function
- Use of stacks, queues
- Use of graphs and trees
- Strategies for choosing the right data structure

Evaluation:
- Final Exam (2 hr long) 60%
- Coursework: 40%
    - 3 Written assignments 15% (5% each)
    - 2 Programming projects 20% (10 each)
    - 1 In-course test (1 hr) 5%

Title: **DYNAMIC WEB DEVELOPMENT 1**
Course Code: **INFO2180**
Credits: **3**
Level: **2**
Semester: **2**
Pre-requisites: **COMP1126, COMP1127 and COMP1161**

Course Content:
- Networking concepts, Internet protocols - TCP/IP. DNS, MIME types.
- XHTML, dynamic XHTML, CSS, DOM. XML, XSLT.
- Overview of website design principles: requirements, concept design, implementation, testing.
- Overview of website UI design: low-fidelity prototyping, layout, use of colour, fonts, controls.

- Server-side frameworks and languages, client-side languages. Basic session tracking.
- Introduction to three-tier architecture.
- Fundamental web frameworks and design patterns for the web.
- Overview of web server architecture and web services standards.
- Web database connectivity.
- Overview of principles, design and frameworks for e-commerce.
- Overview of network security issues, ethical and social issues.
- Introduction to multimedia for the web.
- Introduction to mobile and wireless web platforms.

Evaluation:

- Final Exam (2 hours) 50%
- Coursework: 50%
    - 10 labs 10% (1% each)
    - 5 programming projects 35% (7% each)
    - 1 in-course test (1 hour) 5%

Title: **OPERATING SYSTEMS**
Course Code: **COMP3101**
Credits: **3**
Level: **3**
Semester: **1**
Pre-requisite: **COMP2340**

Course Content:

- **Overview of Operating Systems**
    - Role and purpose of the operating system
    - History of operating system development
    - Functionality of a typical operating system
    - Mechanisms to support client-server models, hand-held devices
    - Design issues (efficiency, robustness, flexibility, portability, security, compatibility)
    - Influences of security, networking, multimedia, windows
- **Operating System Principles**
    - Structuring methods (monolithic, layered, modular, micro-kernel models)
    - Abstractions, processes, and resources
    - Concepts of application program interfaces (APIs)

    - Application needs and the evolution of hardware/software techniques
    - Device organization
    - Interrupts: methods and implementations
    - Concept of user/system state and protection, transition to kernel mode
- **OS/Concurrency**
    - States and state diagrams
    - Structures (ready list, process control blocks, and so forth)
    - Dispatching and context switching
    - The role of interrupts
    - Concurrent execution: advantages and disadvantages
    - The “mutual exclusion” problem and some solutions
    - Deadlock: causes, conditions, prevention
    - Models and mechanisms (semaphores, monitors, condition variables, rendezvous)
    - Producer-consumer problems and synchronization
    - Multiprocessor issues (spin-locks, reentrancy)
- **Scheduling and Dispatch**
    - Preemptive and non-preemptive scheduling
    - Schedulers and policies
    - Processes and threads
    - Deadlines and real-time issues
- **Memory Management**
    - Review of physical memory and memory management hardware
    - Paging and virtual memory
    - Multilevel paging
    - Working sets and thrashing
    - Caching
- **Security and Protection**
    - Overview of system security
    - Policy/mechanism separation
    - Security methods and devices
    - Protection, access control, and authentication
- **File Systems**
    - Files: data, metadata, operations, organization, buffering, sequential, non-sequential
    - Directories: Course Contents and structure
    - File systems: partitioning, mount/unmount, virtual file systems
    - Standard implementation techniques
    - Memory-mapped files
    - Special-purpose file systems

        - Naming, searching, access, backups
- **Device Management**
    - Characteristics of serial and parallel devices
    - Abstracting device differences
    - Buffering strategies
    - Direct memory access
    - Recovery from failures
- **System Performance Evaluation**
    - Policies for caching, paging, scheduling, memory management, security, and so forth
    - Evaluation models: deterministic, analytic, simulation, or implementation-specific
    - How to collect evaluation data (profiling and tracing mechanisms)
- **Scripting**
    - Scripting and the role of scripting languages
    - Basic system commands
    - Creating and executing scripts, parameter passing
- **Trends in Operating Systems**
    - Overview of contemporary operating systems, mobile operating systems
    - Future trends in operating systems

Evaluation:
The course will be assessed as follows:

- Coursework: 50%
    - Two in-course tests (10% each) 20%
    - Two assignments (5% each) 10%
    - Two projects (variable weighting) 20%
- One 2 hour final written examination 50%

Title: **DATABASE MANAGEMENT SYSTEMS**
Course Code: **COMP3161**
Credits: **3**
Level: **3**
Semester: **2**
Pre-requisite: **COMP1210**

Course Content:

- **Information management concepts**
  - Basic information storage and retrieval concepts.
  - Information capture and representation.
- **Database systems**
  - Components of database systems
  - Database architecture and data independence
  - Use of a declarative query language (SQL)
- **Data modelling**
  - Relational data models
  - Object-oriented models
  - Semi-structured data models
- **Relational databases**
  - Relational algebra
  - Relational database design
  - Functional dependency
  - Decomposition of a schema
  - Normal forms
  - Multi-valued dependency
- **Query languages**
  - Overview of database languages
  - SQL (data definition, query formulation, update, constraints, and integrity)
  - Select-project-join
  - Subqueries
  - Querying XML
  - Stored procedures
- **Views and Indexes**
  - Basic structure of an index
  - Creating indexes with SQL
  - Materialized Views
- **Transaction processing**
  - Transactions

- Failure and recovery
- Concurrency control

- **Distributed databases**
    - MapReduce processing model
    - NoSQL systems
- **Advanced topics**
    - Security and user authorization
    - Recursion
    - On-line analytical processing (OLAP)
    - Query optimisation

Evaluation:
This course will be assessed as follows:

• Coursework:	50%	
• One 1-hour in-course examination		10%
• Four assessed labs (equally weighted)		15%
• Eight Quizzes (equally weighted)		5%
• Four assignments (equally weighted)		10%
• One programming project		10%
• One 2-hour final written examination	50%	

Title:	**<u>PRINCIPLES OF COMPUTER NETWORKING</u>**
Course Code:	**COMP3191**
Credits:	**3**
Level:	**3**
Semester:	**1**
Pre-requisite:	**COMP2190 – Net Centric Computing**

Course Content:

- **Architectural principles**
    - Layering
    - Encapsulation
    - Packet switching
    - Naming
    - End-to-end principle
    - Finite state machines
- **Application layer**
    - HTTP (caching and HTTP future)
    - FTP
    - SMTP and electronic mail
    - DNS (recursion)

    - Peer to peer applications
    - Socket programming in TCP and UDP
- **Transport layer**
    - Connectionless transport: UDP
    - Principles of reliable data transfer
    - Connection-oriented transport: TCP
        - TCP Tahoe, TCP Reno, and TCP New Reno.
        - Congestion Control: RTT estimation and Self-clocking
        - Rationale for AIMD
    - Networks and protocols
    - Client/server and peer-to-peer paradigms
    - Mobile and wireless computing
- **Network Layer**
    - Names and addresses: ARP, IPv4, IPv6, and NAT
    - Routing and flooding, source routing, and spanning trees
    - Routingalgorithms: Bellman-Ford, Dijkstra
    - Routing: Intra-AS routing (RIP and OSPF), Inter-AS routing (BGP), and multicast
- **Physical and link layers**
    - Shannon capacity and modulation
    - Bit errors
    - FEC and Reed-Solomon
    - MAC:ALOHA and Slotted ALOHA, CSMA/CD
    - Ethernet and Virtual LANs
    - Wireless: How it is different from wireline communication.
    - Wireless principles: CSMA/CA and RTS/CTS
    - IEEE 802.11
- **Multimedia networking**
    - Course Content-delivery networks
    - Queuing disciplines
    - Quality of service in computer networks.

Evaluation:

This course will be assessed as follows:

Coursework:	50%	
• One 1-hour in-course examination		10%
• 7 Quizzes (equally weighted)		5%
• 2 Individual written assignments		10%
• 2 Individual projects (10% +15%)		25%
One 2-hour final written examination	50%	

Title: **IMPLEMENTATION OF COMPUTER NETWORKS**
Course Code: **COMP3192**
Credits: **3**
Level: **3**
Semester: **2**
Pre-requisite: **COMP3191 – Principles of Computer Networking**

Course Content:

- **Direct Link Networks**
    - Encoding
    - Framing
    - Error Detection
    - Reliable Transmission
    - SONET
    - FDDI
    - Network Adapters
    - Ethernet
    - 802.11 Wireless Networks
- **Packet and Cell Switching**
    - Concepts
    - ATM
    - Switching Hardware
    - Bridges & Extended LANs
- **Internetworking**
    - Internetworking Concepts
    - Global Internet
    - IPv6
    - Internet Multicast
    - Domain Name Services
- **End-to-End Protocols**
    - Concepts
    - UDP
    - TCP
    - APIs and Sockets
    - RPCs
    - Performance
- **End-to-End Data**
    - Presentation Formatting
    - Data Compression
    - Security
- **Congestion Control**
    - Issues

- Queuing Disciplines
    - TCP Congestion Control
    - Congestion Avoidance
- **High Speed Networking**
    - Performance Issues
    - Advanced Services
    - Experiences
- **Voice Over IP**
    - Overview
    - Peer to Peer calling
    - Call Managers, Call Signalling
    - PBX and Call Attendant Functionality
- **Routing protocols**
    - IGPs and EGPs
    - Overview of RIP and OSPF
    - Introduction to BGP

Evaluation:

This course will be assessed as follows:

Coursework:	60%	
• One 1-hour in-course examination		10%
		15%
• 13 quizzes (equal weighting)		20%
• 13 lab reports (equal weighting)		15%
• Weekly participation		
One 2-hour final written examination	40%	

Title: **PRINCIPLES OF ARTIFICIAL INTELLIGENCE**
Course Code: **COMP3220**
Credits: **3**
Level: **3**
Semester: **1**
Prerequisites: **COMP2201 – Discrete Mathematics, COMP2211 – Analysis of Algorithms**

Course Content:

- **Introduction to AI**
    - Overview and History of AI and Philosophical Issues in AI
- **Intelligent Agents**
    - Performance measures, Environment, Actuators and Sensors (PEAS)
    - Environment types

- Agent types
- **Search**
    - Uninformed search algorithms
    - Heuristic search algorithms
    - Iterative improvement algorithms
    - Game playing
- **Knowledge Representation and reasoning**
    - Logic
    - Production rules
    - Inferencing mechanisms
    - Expert systems
- **Current topics in AI**
- **Machine learning**
    - Neural networks
    - Reasoning under uncertainty
    - Natural Language processing
    - Speech recognition
    - Robotics
    - Fuzzy logic
    - Virtual Reality

Evaluation:

This course will be assessed as follows:

- One 2-hour final written examination 60%
- Coursework: 40%
    - One in-Course Test 10%
    - One written assignment 10%
    - One programming assignment 10%
    - One research paper 10%

Title: **USER INTERFACE DESIGN**
Course Code: **COMP3270**
Credits: **3**
Level: **3**
Semester: **1 or 2**
Pre-requisite: **INFO2180- Dynamic Web Development I, or COMP2140- Software Engineering**

Course Content:

HCI Overview

- The role of user interfaces in computer applications.
- History of human-computer interaction (HCI) and user interface (UI) systems.
- Contexts for HCI (anything with a user interface: webpage, business applications, mobile applications, games, etc.)
- Physical and Cognitive models that inform interaction design: attention, vision, perception and recognition, movement, and memory. Ergonomics.
- HCI models such as Norman's Gulfs of execution and evaluation.
- Accessibility: interfaces for differently-abled populations (e.g. blind, motion-impaired)
- Interfaces for differently-aged population groups (e.g. children, 80+)
- Social models that inform interaction design: culture, communication, networks and organizations.

UI Design Methods

- Processes for user-centred development: early focus on users, evaluation, iterative design.
- Different measures for evaluation: utility, efficiency, learnability, user satisfaction.
- Usability goals and User experience goals in design and evaluation
- Principles of good design and good designers; engineering tradeoffs
- Techniques for gathering requirements: interviews, surveys, ethnographic & contextual enquiry, participatory design
- Techniques and tools for analysis & presentation of requirements: reports, personas
- Choosing interaction styles and interaction techniques
- Representing information to users: navigation, representation, manipulation visualisation
- Approaches to design, implementation and evaluation of non-mouse interaction
- Prototyping techniques and tools: sketching, storyboards, low-fidelity prototyping, wireframes
- User-centred error and exception handling, contextual help.

- Evaluation without users, using both qualitative and quantitative techniques: walkthroughs, expert-based analysis, heuristics, guidelines and standards, keystroke-level models.
- Evaluation with users: observation, think-aloud, interview, survey, experiment.
- Challenges to effective evaluation: sampling, generalization.
- Analysing and reporting the results of evaluations.
- Internationalisation, designing for users from other cultures, cross-cultural evaluation.

Interaction Paradigms

- Asynchronous group communication: e-mail, forums.
- Synchronous group communication: chat rooms, conferencing, online games.
- Online communities and social networking: positive and negative uses
- Introduction to touch and multi-touch interfaces, mobile platforms (iPhone, Android, Windows, etc), viewer and object tracking, pose and gesture recognition, accelerometers.
- HCI issues in Speech recognition and natural language processing.
- Software characters and intelligent agents, virtual worlds and avatars.
- Future UI trends, e.g. 3D Stereoscopic displays, force feedback simulation, haptic devices, wearable and tangible interfaces, persuasive interaction and emotion, ubiquitous and context-aware UI, ambient/peripheral display and interaction.

Evaluation:

- The course will be assessed as follows:
- One 2-hour final written examination 50%
- Two group projects (variable weighting) 45%
- One In-course test 5%

Student contribution to group projects will be individually assessed.

Title:	**<u>LANGUAGE PROCESSORS</u>**
Course Code:	**COMP3652**
Credits:	**3**
Level:	**3**
Semester:	**1 or 2**
Pre-requisite:	**COMP2211- Analysis of Algorithms**

Course Content:

- Syntactic Processing
  - Context Free Grammars: Definition, BNF notation, ambiguity, parse trees and deriva-tions
  - Regular Expressions: Definition, JLex or JFlex (a lexing tool)
  - Parsing: top down (recursive descent and LL(K))
  - Parsing: bottom up (LR(0), SLR, LALR(1) and LR(1) parsers)
- Semantic Representation and Processing
  - Operational vs. Denotational semantics
  - POSTFIX: an example of a stack-based programming language
  - Syntax-directed interpretation (and translation)
  - Abstract Syntax Trees as Intermediate Representations
  - Interpretation and translation by AST traversal
- Features of Programming Languages
  - Typing: static vs. dynamic
  - Scoping: static vs. dynamic
  - Evaluation: lazy vs. eager
  - Parameter passing conventions
  - Data allocation strategies
  - First class citizens (objects)
  - Tail recursion
  - Garbage collection

Evaluation:

The course will be assessed as follows:

Coursework:		60%
• One (1) written homework assignments	10%	
• Two programming assignment	20%	
• One (1) project	30%	
One 2-hour final written examination		40%

Title:	**<u>THEORY OF COMPUTATION</u>**
Course Code:	**COMP3702**
Credits:	**3**
Level:	**3**
Semester:	**2**
Prerequisite:	**COMP2201- Discrete Mathematics for Computer Science**

Course Content:

- **Computability**
    - Regular languages (DFA, NFA, Regular Expressions)
    - Context Free languages (CFGs, PDAs)
    - Turing-recognisable languages (Turing Machines)
    - Church-Turing thesis (Lambda Calculus)
    - Turing reducibility and Mapping reducibility
    - Undecidability
- **Complexity Theory**
    - Distinction between time and space complexity
    - Definitions of complexity classes: L, P, NP, PSPACE, EXPTIME
    - Effect of Nondeterminism on Space and Time complexity
    - Polynomial time mapping reducibility
    - Hardness and completeness relative to various complexity classes (e.g. NP-hardness, NP-completeness)
    - Example NP-complete problems

Evaluation:

Coursework:	50%	
• One (1) in-course examination		10%
• Five (5) written homework assignments		40%
One 2-hour final written examination	50%	

Title:	**<u>REAL TIME EMBEDDED SYSTEMS</u>**
Course Code:	**COMP3801**
Credits:	**3**
Level:	**3**
Semester:	**I**
Pre-requisites:	**COMP2340 – Computer Systems Organisation, and COMP2140 – Software Engineering**

Course Content:

- **Sensors, Actuators and Electrical components**
  - Analogue to Digital conversion, Sensor Modules
  - Formatting Sensor Input
  - Actuator Selection, Embedded hardware components
  - Hardware components for signal processing
- **State, Control and Feedback**
  - State diagrams and Petri Nets
  - Control and Feedback
  - Controllers
- **Embedded Design**
  - Hardware/Software Co-design
  - Fault Tolerance
- **Real Time Operating Systems**
  - Real Time Operating Systems
  - RTOS Example, e.g.,VxWorks
- **Robotics and multi-platform Programming**
  - Introduction to Robotics
  - Introduction to Mobile Programming with J2ME
  - Developing and deploying mobile applications
  - Load Balancing in Embedded Systems

Evaluation:

The course will be assessed as follows:

Coursework:	60%	
• Mid-semester exam		10%
• Two individual assignments (5% each)		10%
• Four group projects (10% each)		40%
One 2-hour final written examination	40%	

Title: **<u>CAPSTONE PROJECT</u>**
Course Code: **COMP3901**
Credits: **3**
Level: **3**
Semester: **2 and Summer**
Prerequisites: **COMP2140: Software Engineering COMP2211: Analysis of Algorithms, and Any 6 credits of Level 2 or 3 computing code courses**

Course Content:

The specific technical topics covered by each group will depend on the type of project. Common examples of such topics include (but are not limited to):

- database design
- web programming,
- user-interface design
- mobile application development
- algorithm design

Evaluation:
This course is assessed via a series of presentations and a demonstration, a written report and a Web page. The specific contribution of each component towards the overall grade for a group is as follows:

Coursework:	100%
• Midterm presentation	10%
• Final presentation	15%
• Final demonstration	15%
• Final Report	50%
• Web Page	10%

The presentations, demonstrations and Web pages are assessed by the evaluation committee. Each group final report is assessed by its supervisor and group members peer-assess each other. This combined level of assessment allows for individual grading.

Title: **<u>INTERNSHIP IN COMPUTING I</u>**
Course Code: **COMP3911**
Credits: **3 credits**
Level: **3**
Pre-requisite: **Permission of the Head of Department**
Semester: **All**

Course Content:
The exact nature of the internship depends upon the interests of the student and the specific needs of the cooperating organisation. It is assumed and expected that the intern will be involved in some area of computing and thereby gain valuable experience in his/her selected field of study.

Internships contribute to the education of the whole person by emphasizing the importance of work and by providing opportunities for self-reflection. The internship should be chosen to build on the student's own interests and to relate what he/she has learned in school to its application in the workplace. In addition, the internship should help the student evaluate him/herself as a worker and as a potential employee in a particular professional field. Through the internship, the

student will enhance his/her feelings of self-worth and confidence in performing in the workplace.
While on the job, the student should not only apply lessons learned in school to his/her particular job tasks, but he/she should also explore vocational possibilities and seek to discover what kinds of work he/she enjoys. In addition, the student will be able to build on his/her résumé and professional portfolio. Internship experiences should also offer the student access to potential mentors in his/her professional field.

Responsibility of the Student:
The student is required to spend about l50 working hours (e.g. 12 hours per week for approximately 13 weeks during semester 1 or 2, or 40 hours per week for approximately 4 weeks) working on a project or projects of the participating organisation's choice. Where the students are registered for the course in semester 1 or 2, the hours allotted for the internship exercise should be selected by the student, at times when no classes are scheduled.

The student must:

- meet regularly with the Departmental Internship Coordinator (IC) and periodically with fellow interns to discuss his/her internship experiences
- maintain a journal indicating dates and hours worked, and a brief description of the work performed
- submit a final report summarising and evaluating the internship experience; and
- complete a résumé and interview at the Office of Placement and Career Services, UWI (Mona)

Any problems encountered during the internship should be discussed immediately with the IC so that appropriate action can be taken.

Responsibility of the participating Organisation:
Participating organisations will be vetted by the Internship Coordinator to ensure that they are suitable.

The organisation will:

- provide a mentor and appropriate work environment
- expose the student to the type of work which he/she would encounter in an entry level professional position
- provide appropriate personnel to oversee the project(s) assigned to the student, and the resources needed to accomplish the work
- treat the student as it would any employee, and
- expect the same degree of responsibility from the student, even as the student is not an employee of the firm

The mentor will be asked to:

- provide a written evaluation of the student's performance to the IC at the end of the internship
- provide the student with a periodic evaluation of his/her performance; and
- consult with the IC when and if necessary.

Although an internship is a learning experience, it is expected that the student will normally earn some compensation for work performed that may contribute to income generating activities, either in the form of a wage, stipend, or reimbursement of expenses.

Responsibility of the Internship Coordinator (IC):

The IC will:

- organise preparation seminars for students at the start of each semester., featuring presentations from the Office of Placement and Career Services, industry personnel and alumni
- arrange preliminary meetings with mentors where students are briefed on expectations and responsibilities specific to the organisation
- meet/correspond with students: student group meetings (weekly) via online journal, videoconference, etc. for students to share experiences
- review reports from the organisation
- review reports from the student
- serve as a liaison between the Department of Computing (DoC) and the participating organisation
- oversee the progress of the intern
- make suggestions to both the student and the organisation on ways to enhance the benefits of the internship
- meet regularly with the intern to discuss his/her experiences
- help resolve any problems the organisation and the student might have
- review all the reports submitted by the participating organisation and the student

Evaluation:

There will be two components of the course's assessment: the internship mentor's evaluation and the student's work during the internship and his/her final submission at the conclusion of the internship. Students must pass both aspects of the course.

The internship mentor will provide a written evaluation of the student's performance. This assessment will be done using a 5 point Likert scale**.** An assessment/evaluation form will be provided for this purpose, and the form will be returned to the DoC in a sealed envelope. The internship coordinator will assign a grade not exceeding 25% of the possible marks based on this assessment, and on the student's journal which would detail the tasks assigned to the student and their level of completion.

The student will be evaluated on:

- Quality of work
- Use of time (efficient/effective use of time to complete tasks)
- Ability to take initiative (ability to work independently)
- Grasp of subject (understanding of applicable standards and procedures)
- Judgement skills (ability to make appropriate work-related decisions)
- Interpersonal relations/teamwork (effectiveness in working with peers and supervisors)
- Adaptability (ability to alter activities to accommodate change)
- Problem solving/critical thinking skills
- Punctuality, attendance
- Verbal and written communication skills
- Whether the goals of the internship were met (qualitative response)
- What skills the student developed (qualitative response)
- The observed primary strengths of the intern (qualitative response)
- Recommendations for improvement (qualitative response)
- What is your overall assessment of the student's performance? (qualitative response)
- Other relevant observations.

75% will be based on the following:

- regular communication with the DIC (weekly reports) – 15%
- attendance at and participation in required internship meetings (weekly) - 10%;
- oral presentation summarizing the activities completed during the internship - 20%
- documentation of the internship experience in an Internship Portfolio (30%) which includes:
  - a final report summarizing the internship, relating it to courses done, and reflecting on the experience. The final report will have an appendix containing the student's journal entries from the internship (guidelines will be provided).
  - an updated résumé that incorporates the internship experience.
  - a "Company Evaluation Form" rating the participating organisation.
  - proof of consultation/debriefing with the Office of Placement and Career Services, UWI (Mona)

Title: **INTERNSHIP IN COMPUTING II**
Course Code: **COMP3912**
Credits: **6 credits**
Level: **3**
Prerequisite: **Permission of the Head of Department**
Semester: **All**

Course Content:
The exact nature of the internship depends upon the interests of the student and the specific needs of the cooperating organisation. It is assumed and expected that the intern will be involved in some area of computing and thereby gain valuable experience in his/her selected field of study.

Internships contribute to the education of the whole person by emphasizing the importance of work and by providing opportunities for self-reflection. The internship should be chosen to build on the student's own interests and to relate what he/she has learned in school to its application in the workplace. In addition, the internship should help the student evaluate him/herself as a worker and as a potential employee in a particular professional field. Through the internship, the student will enhance his/her feelings of self-worth and confidence in performing in the workplace.

While on the job, the student should not only apply lessons learned in school to his/her particular job tasks, but he/she should also explore vocational possibilities and seek to discover what kinds of work he/she enjoys. In addition, the student will be able to build on his/her résumé and professional portfolio. Internship experiences should also offer the student access to potential mentors in his/her professional field.

***Responsibility of the Student*:**
The student is required to spend about l50 working hours (e.g. 12 hours per week for approximately 13 weeks during semester 1 or 2, or 40 hours per week for approximately 4 weeks) working on a project or projects of the participating organisation's choice. Where the students are registered for the course in semester 1 or 2, the hours allotted for the internship exercise should be selected by the student, at times when no classes are scheduled.

The student must:

- meet regularly with the Departmental Internship Coordinator (IC) and periodically with fellow interns to discuss his/her internship experiences
- maintain a journal indicating dates and hours worked, and a brief description of the work performed

- submit a final report summarising and evaluating the internship experience; and
- complete a résumé and interview at the Office of Placement and Career Services, UWI (Mona)

Any problems encountered during the internship should be discussed immediately with the IC so that appropriate action can be taken.

Responsibility of the participating Organisation:
Participating organisations will be vetted by the Internship Coordinator to ensure that they are suitable.

The organisation will:

- provide a mentor and appropriate work environment
- expose the student to the type of work which he/she would encounter in an entry level professional position
- provide appropriate personnel to oversee the project(s) assigned to the student, and the resources needed to accomplish the work
- treat the student as it would any employee, and
- expect the same degree of responsibility from the student, even as the student is not an employee of the firm

The mentor will be asked to:

- provide a written evaluation of the student's performance to the IC at the end of the internship
- provide the student with a periodic evaluation of his/her performance; and
- consult with the IC when and if necessary.

Although an internship is a learning experience, it is expected that the student will normally earn some compensation for work performed that may contribute to income generating activities, either in the form of a wage, stipend, or reimbursement of expenses.

Responsibility of the Internship Coordinator (IC):
The IC will:

- organise preparation seminars for students at the start of each semester., featuring presentations from the Office of Placement and Career Services, industry personnel and alumni
- arrange preliminary meetings with mentors where students are briefed on expectations and responsibilities specific to the organisation
- meet/correspond with students: student group meetings (weekly) via online journal, videoconference, etc. for students to share experiences
- review reports from the organisation

- review reports from the student
- serve as a liaison between the Department of Computing (DoC) and the participating organisation
- oversee the progress of the intern
- make suggestions to both the student and the organisation on ways to enhance the benefits of the internship
- meet regularly with the intern to discuss his/her experiences
- help resolve any problems the organisation and the student might have
- review all the reports submitted by the participating organisation and the student

Evaluation:
There will be two components of the course's assessment: the internship mentor's evaluation and the student's work during the internship and his/her final submission at the conclusion of the internship. Students must pass both aspects of the course.

The internship mentor will provide a written evaluation of the student's performance. This assessment will be done using a 5 point Likert scale**.** An assessment/evaluation form will be provided for this purpose, and the form will be returned to the DoC in a sealed envelope. The internship coordinator will assign a grade not exceeding 25% of the possible marks based on this assessment, and on the student's journal which would detail the tasks assigned to the student and their level of completion.
The student will be evaluated on:

- Quality of work
- Use of time (efficient/effective use of time to complete tasks)
- Ability to take initiative (ability to work independently)
- Grasp of subject (understanding of applicable standards and procedures)
- Judgement skills (ability to make appropriate work-related decisions)
- Interpersonal relations/teamwork (effectiveness in working with peers and supervisors)
- Adaptability (ability to alter activities to accommodate change)
- Problem solving/critical thinking skills
- Punctuality, attendance
- Verbal and written communication skills
- Whether the goals of the internship were met (qualitative response)
- What skills the student developed (qualitative response)
- The observed primary strengths of the intern (qualitative response)
- Recommendations for improvement (qualitative response)
- What is your overall assessment of the student's performance? (qualitative response)

- Other relevant observations.

75% will be based on the following:

- regular communication with the DIC (weekly reports) – 15%
- attendance at and participation in required internship meetings (weekly) - 10%;
- oral presentation summarizing the activities completed during the internship - 20%
- documentation of the internship experience in an Internship Portfolio (30%) which includes:
    - a final report summarizing the internship, relating it to courses done, and reflecting on the experience. The final report will have an appendix containing the student's journal entries from the internship (guidelines will be provided).
    - an updated résumé that incorporates the internship experience.
    - a "Company Evaluation Form" rating the participating organisation.
    - proof of consultation/debriefing with the Office of Placement and Career Services, UWI (Mona)

Title:	**<u>COMPUTER SYSTEM ADMINISTRATION</u>**
Course Code:	**INFO3105**
Credits:	**3**
Level:	**3**
Pre-requisite:	**COMP2340, COMP2190**
Semester:	**1**

Course Content:

- **Operating systems**
    - Overview
    - Operating system principles
    - Concurrency, Scheduling and dispatch
    - Memory management
    - Device management
    - Security and protection
    - File systems
    - Real-time and embedded systems
    - Fault tolerance
    - Scripting
    - Virtualisation
    - Installation, configuration and maintenance of OS and Applications
    - Installation and Configuration

    - Maintenance (upgrades, patches, etc.)
    - Server services (print, file, DHCP, DNS, FTP, HTTP, mail, SNMP, telnet)
    - Application Management (database, web, network services, etc.)
    - Deployment of a system image using imaging software.
    - Support and Licensing issues
- **Administration Activities**
    - Content management
    - Content deployment (file system planning and Structure)
    - Server administration and management
    - User and group management
    - Backup management
    - Security management
    - Disaster recovery
    - Resource management
    - Automation management (automatic job scheduling)
    - Use of site management logs
    - System support
- **Administrative domains**
    - Web, Network, OS, Support, Database
- **Power management**
    - Power requirements for individual systems
    - Heat and power budgets
    - Power load monitoring and management

Evaluation:

2-hour written final: 50%

Coursework: 50%

- 2 Written assignments 20% (10% each)
- 5 Labs 20% (4% each)
- 1 Programming project 10%

Title:	**<u>INFORMATION SYSTEMS</u>**
Course Code:	**INFO3110**
Credits:	**3**
Level:	**3**
Pre-requisites:	**COMP2140 and COMP2190**
Semester:	**2**

Course Content:

- **Characteristics of an Organization**
    - Business Functions
    1. Management Hierarchy
    - Business Processes
- **Information systems**
    - Types of Applications
    - Enterprise Systems
    - Supply Chain Management Systems
    1. Customer Relationship Management Systems
    - Knowledge Management Systems
- **Information Systems and Business Strategy**
    - Corporate Strategy
    - Information Systems Strategy
    - Strategic Information Systems
- **Information Technology Infrastructure**
    - Computer Hardware
    - System Software
    - Data Management
    - Telecommunication Networks
- **IT for business intelligence gathering**
    - Data mining
    - Artificial Intelligence
    - Environment Scanning
- **Internet and Other IT Innovations**
    - E-Commerce
    - E-Business
    - Collaborative Commerce
- **Managing Information Systems**
    - Information Systems Security and Control
    - Disaster Planning and Recovery

Evaluation:

Final Exam (2-hour long) 60%

- Coursework: 40%
    - 3 assignments 30% (10% each)
    - In-Course Test 10%

Title: **INFORMATION ASSURANCE AND SECURITY**
Course Code: **INFO3155**
Credits: **3**
Level: **3**
Pre-requisite: **COMP2190 and (COMP2201 or INFO2100)**
Semester: **2**

Course Content:

- The reality for the growing need of security in our day to day tasks.
- Confidentiality, integrity and availability: the pillars of security.
- The ethical issues facing the security professional.
- Physical access to information resources: secure sites, security policies, backups, disaster recovery
- The human factor: social engineering
- Malware: viruses, worms, Trojan horses, mailers etc
- Penetration testing: threat discovery, assessment and system hardening.
- Confidentiality, integrity and non-repudiation: the use of cryptography in security (hash functions, message digests, public/private key cryptography)

Evaluation:

Final Exam (2-hour long) 60%

- Coursework: 40%
  - 2 assignments 25%
  - Programming project 15%

Title: **USER INTERFACE DESIGN FOR IT**
Course Code: **INFO3170**
Credits: **3**
Level: **3**
Pre-requisites: **COMP2160 or COMP2140 or INFO2180**
Semester: **1**

Course Content:

- **Overview of HCI**
  - The role of user interfaces in computer applications.
  - History of human-computer interaction (HCI) and user interface (UI) systems.
  - Human Factors: perception, movement, and cognition. Ergonomics.

    - Contextual issues in HCI: culture, communication, and organizations.
    - HCI models. UI paradigms: command, graphical user interface (GUI), etc. UI Guidelines.
- **UI Environments**
    - Overview of graphics systems, display devices, input devices.
    - GUI system architecture, event-driven interaction model. UI toolkits.
    - Collaborative Systems. Embedded Systems.
- **UI Development Methods**
    - UI development cycle: investigation, design, prototyping, evaluation, implementation.
    - Developing UI requirements: inquiry methods, developing task and workflow models.
    - Information collection and analysis methods.
    - Prototyping: storyboarding, implementation.
    - Evaluation methods: heuristic, observational, empirical.

Evaluation:

- Final Exam (2-hour long) 50%
- Coursework: 50%
    - In-course test (1hr) 5%
    - Programming projects 45%

Title: **<u>DYNAMIC WEB DEVELOPMENT II</u>**
Course Code: **INFO3180**
Credits: **3**
Level: **3**
Semester: **1**
Pre-requisite: **INFO2180**

Course Content:

- DOM. XML, XSLT, AJAX.
- Web application design principles: requirements, concept design, implementation, testing.
- Web application UI design: low-fidelity prototyping, layout, use of colour, fonts, controls.
- Further server-side frameworks and languages, client-side languages. Session tracking.
- *n*-tier architecture for the web.

- Service-oriented architectures.
- Web frameworks and design patterns for the web.
- Web server architecture and web services standards.
- Principles, design and frameworks for e-commerce.
- Web security issues: cross-site scripting, SQL injection, phishing
- Web network security issues, ethical and social issues.
- Multimedia for the web.
- Mobile and wireless web platforms.

Evaluation:

- Final Exam (2 hr long) 50%
- Coursework: 50%
    - 10 labs 10% (1% each)
    - 5 programming projects 35% (7% each)
    - 1 in-course test (1 hr) 5%

Title:	**<u>ECOMMERCE</u>**
Course Code:	**INFO3435**
Credits:	**3**
Level:	**3**
Pre-requisites:	**COMP2140, INFO2180**
Semester:	**2**

Course Content:

- eCommerce business models and concepts
- The Internet and World Wide Web: e-Commerce Infrastructure
- Building eCommerce web site
- eCommerce website evaluation and usability testing. Personalization & customization
- Online security and payment systems
- eCommerce marketing concepts
- eCommerce marketing communications
- Ethical, social, and political issues in eCommerce
- Online retailing and services
- Online **Course Content**and media
- Social networks, auctions, and portals
- B2B eCommerce: supply chain management and collaborative commerce

Evaluation:

- Final Exam (2-hour long) 60%
- Coursework: 40%
  - 3 Assignments 30% (10% each)
  - In-Course Test (1 hr) 10%

Title	**<u>SOFTWARE PROJECT MANAGEMENT</u>**
Course Code	**SWEN3130**
Credits	**3**
Level	**3**
Pre-requisite	**COMP2140 – Software Engineering**
Semester	**1**

Course Content:

- **The role of risk in the software life cycle:**
  - Risk categories including security, safety, market, financial, technology, people, quality, structure and process
  - Risk identification
  - Risk tolerance e.g., risk-adverse, risk-neutral, risk-seeking)
  - Risk planning
  - Risk removal, reduction and control
- **Working in teams:**
  - Professional ethics
  - Participation
  - Processes including responsibilities for tasks, meeting structure, and work schedule in a software team
  - Team conflict resolution
  - Virtual teams (communication, perception, structure)
  - Effort Estimation (at the personal level)
  - Team management including organisation, decision-making, role identification and assignment, individual and team performance assessment
- **Project management:**
  - Scheduling and tracking
  - Project management tools
  - Cost/benefit analysis
  - Software measurement and estimation techniques
  - Configuration management and version control
  - Principles of risk management

Evaluation:
The coursework will consist of at least two group assignments. The projects are designed for students to gain a better understanding of being effective team members and producing deliverables within time and other project related constraints. The projects will also afford students the opportunity to use and familiarise themselves with project management software tools.

- Final written examination (2 hours) 60%
- Coursework: group assignments (20% each) 40%

Title	**<u>SOFTWARE MODELING</u>**
Course Code	**SWEN3145**
Credits	**3**
Level	**3**
Pre-requisites	**COMP2140 - Software Engineering AND COMP2170 – Object Technology**
Semester	**1**

Course Content:

- **Requirements specification document development**
  - Precisely expressing requirements
- **Information modeling**
  - entity-relationship modeling
  - class diagrams
- **Behavioral modeling**
  - structured analysis
  - state diagrams
  - use case analysis
  - interaction diagrams
  - failure modes and effects analysis
- **Structure modeling**
  - architectural
- **Domain modeling**
  - domain engineering approaches
- **Functional modeling**
  - component diagrams

Evaluation:
At the end of the course students must be able to demonstrate their understanding of, and ability to produce, models of software systems. The course therefore, has a greater weight attributed to the coursework component. The assignments are

focused on developing the students' basic software modeling skills while the project will require the application of these acquired skills to a simple, yet comprehensive problem.

- Final written examination (2 hours) 40%
- Coursework: 60%
    - Project (1) 40%
    - Assignments (2) 10% each

Title: **SOFTWARE TESTING**
Course Code: **SWEN3165**
Credits: **3**
Level: **3**
Pre-requisites: **COMP2140 – Software Engineering AND COMP2170 – Object Technology**
Semester: **2**

Course Content:

- Managing the testing process
- Testing principles and techniques:
    - unit
    - integration
    - systems
    - acceptance
- Testing types:
    - state based
    - regression
    - configuration
    - compatibility
    - alpha, beta, and acceptance
- Test driven development
- Test plan development
- Reporting, tracking, and analysis of problems encountered during development

Evaluation

Students must demonstrate an ability to engage in the development of a small software system using test-driven development. The project, the main component of the coursework, is a multi-stage approach to solving a comprehensive problem that includes the development of unit requirements, creation of appropriate unit tests from the requirements, unit coding, testing, and unit integration/revision/omission. The assignments will test their knowledge and understanding of the various aspects of test-driven development.

- Final written examination (2 hours) 40%
- Coursework: 60%
    - Project report (1) 40%
    - Assignments (2) 10% each

Title:	**<u>FORMAL METHODS AND SOFTWARE RELIABILITY</u>**
Course Code:	**SWEN3185**
Credits:	**3**
Level:	**3**
Pre-requisite:	**COMP2201 – Discrete Mathematics for Computer Science**
Semester:	**2**

Course Content:

- Role of formal specification and analysis techniques in the software development cycle
- Software reliability engineering concepts and practices
- Software reliability models
- Introduction to mathematical models and specification languages (Alloy, Z, VDM)
- Pre and post conditions, invariants
- Formal approaches to software modeling and analysis
  a. Model checkers
  b. Model finders
- Tools in support of formal methods

Evaluation:

At the end of the course students must be able to demonstrate their understanding of, and ability to produce, formal specifications of software systems. The course therefore, has a greater weight attributed to the coursework component. The assignments are focused on developing the students' knowledge and understanding of the mathematical specification and analysis of software system's designs, while the project is a simplified, yet comprehensive problem that requires the application of their knowledge of the mathematical description of software, and the use of a formal specification tool to support the development of such specifications.

- Final Written Examination (2 hours) 40%
- Coursework: 60%
    - Project (1) 40%
    - Assignments (2) 10% each

Title:	**CAPSTONE PROJECT (SOFTWARE ENGINEERING)**
Course Code:	**SWEN3920**
Credits:	**6**
Level:	**3**
Pre-requisites:	**COMP2201 – Discrete Mathematics for Computer Science AND SWEN3130 – Software Project Management AND SWEN3145 – Software Modeling**
Semesters:	**1, 2 and 3**

Course Description:
This course is the required group project course for all students majoring in software engineering. It is intended to be a capstone course that will bring together many of the topics that were covered in the rest of the curriculum. For this reason, students will be expected to take this course in their final year, for a period of six months beginning in semester two and ending in semester three. The project must encompass all matters relating to the software engineering process: requirements, design, coding, working in teams and project management.

Evaluation:
The final mark for each project will be based on documents, artifacts, presentations and demonstrations (where appropriate) of the following:

- Project management charter and plan 15%
- Software requirements specification 30%
- Architecture and design 15%
- Software artifacts 30%
- Presentation and demonstration of final product 10%

Department OF Geography & Geology

MAJORS
Geography
Geology

MINORS
Geography
Geology

UNDEGRADUATE GEOGRAPHY COURSES OFFERED BY THE DEPARTMENT OF GEOGRAPHY AND GEOLOGY

CODE	TITLE	CRE DITS	SEMESTER OFFERED	LEVEL	PRE-REQUISITES
LEVEL 1					
GEOG1131	**Human Geography 1: Population, Migration & Human Settlement**	**3**	**1**	**1**	**FST Matriculation Requirements and Geography at CSEC or its equivalent**
GEOG1132	**Human Geography 2: World Economy, Agriculture & Food**	**3**	**1**	**1**	**FST Matriculation Requirements and Geography at CSEC or its equivalent**
GEOG1231	**Earth Environments 1: Geomorphology & Soils**	**3**	**2**	**1**	**FST Matriculation Requirements and Geography at CSEC or its equivalent**
GEOG1232	**Earth Environments 2: Climate & the Biosphere**	**3**	**2**	**1**	**FST Matriculation Requirements and Geography at CSEC or its equivalent**
LEVEL 2					
GEOG2131	**Urban Geographies**	**3**	**1**	**2**	**GEOG1131 and GEOG1132**
GEOG2132	**Geographies of Development**	**3**	**2**	**2**	**GEOG1131 and GEOG1132**
GEOG2231	**Earth Surface Processes**	**3**	**1**	**2**	**GEOG1231 and GEOG1232**

GEOG2232	**Environmental Change**	**3**	**2**	**2**	**GEOG1231 and GEOG1232**
GEOG2331	**Research Methods in Geography**	**3**	**1**	**2**	**GEOG1131 and GEOG1132 and GEOG1231 and GEOG1232**
GGEO2233	**Water Resources**	**3**	**1**	**2**	**[GEOG1231 and GEOG1232] or [GEOL1102 and GEOL1104]**
GGEO2332	**Introduction to Geographical Information Systems**	**3**	**2**	**2**	**Two of: [GEOG1131/GEOG1132/GEOG1231/ GEOG1232] or Two of: [GEOL1101/GEOL1102/GEOL1103/ GEOL1104]**
LEVEL 3					
GEOG3131	**Tropical Agricultural & Development**	**3**	**1**	**3**	**GEOG2132**
GEOG3132	**Tourism Planning & Development**	**3**	**2**	**3**	**GEOG2131 or GEOG2132**
GEOG3331	**Geography of the Caribbean**	**3**	**1**	**3**	**Three of: [GEOG2131/GEOG2132/GEOG2231/ GEOG2232]**
GEOG3333	**Urban and Regional Planning**	**3**	**2**	**3**	**GEOG2131**
GEOG3334	**Tropical Land Management**	**3**	**1**	**3**	**GEOG2231, GEOG2232 and GEOG2132**
GEOG3430	**Geography Research Project**	**6**	**Year-long**	**3**	**GEOG2331 and GGEO2332 and two from: [GEOG2131/GEOG2132/ GEOG2231/GEOG2232]**

GGEO3231	**Karst & Coastal Geomorphology**	**3**	**2**	**3**	**GEOG2231 or GEOL2202**
GGEO3232	**Climate Change in the Tropics**	**3**	**1**	**3**	**GEOG2232 or any one of, GEOL2201, GEOL2202, GEOL2203, GEOL2204, GEOL2205, or Permission of HOD**
GGEO3233	**Hydrology & Hydrological Modelling**	**3**	**1**	**3**	**GGEO2233**
GGEO3332	**Disaster Management**	**3**	**2**	**3**	**GEOG2231 and GEOG2232 or any two of GEOL2201, GEOl2202, GEOL2203, GEOL2204, GEOL2205 or Permission of HOD**
GGEO3401	**Research Project in Geosciences**	**6**	**1 and 2**	**3**	**GEOL2204 and GGEO2332 and any three of GEOG2231, GEOG2232, GEOL2201, GEOL2205,GGEO2233 Students must be pursuing the Major in Geosciences**

UNDERGRADUATE GEOLOGY COURSES OFFERED BY THE DEPARTMENT OF GEOGRAPHY AND GEOLOGY

CODE	TITLE	CREDITS	SEMESTER OFFERED	LEVEL	PRE-REQUISITES
LEVEL 1					
GEOL1101	Earth Science 1: Earth Materials & Plate Tectonics	3	1	1	Two Science subjects at CAPE or equivalent
GEOL1102	Earth Science 2: Earth Processes & Earth History	3	1	1	Two Science subjects at CAPE or equivalent
GEOL1103	Earth Science 3: Minerals & Mineral Deposits	3	2	1	Two Science subjects at CAPE or equivalent
GEOL1104	Earth Science 4: Geological Maps & Environmental Geology	3	2	1	Two Science subjects at CAPE or equivalent
LEVEL 2					
GEOL2201	Palaeontology & the History of Life	3	2	2	[GEOL1101 and GEOL1102] or [BIOL1262 and BIOL1263]

GEOL2202	**Sedimentary Geology**	**3**	**1**	**2**	**GEOL1101 and GEOL1102**
GEOL2203	**Petrology of Igneous & Metamorphic Rocks**	**3**	**1**	**2**	**GEOL1101 and GEOL1103**
GEOL2204	**Field Techniques for Geology**	**3**	**2**	**2**	**GEOL1101 and GEOL1102 and GEOL1104**
GEOL2205	**Plate Tectonics & Geological Structures**	**3**	**2**	**2**	**GEOL1101 and GEOL1102 and GEOL1104**
GGEO2233	**Water Resources**	**3**	**1**	**2**	**[GEOG1231 and GEOG1232] or [GEOL1102 and GEOL1104]**
GGEO2332	**Introduction to Geographical Information Systems**	**3**	**2**	**2**	**Two of: [GEOG1131/GEOG1132/GEOG1231/GEOG1232] or Two of : [GEOL1101/GEOL1102/GEOL1103/GEOL1104]**
LEVEL 3					
GEOL3100	**Research Project in Field Geology**	**6**	**1 and 2**	**3**	**GEOL2204 and any three of: [GEOL2201/GEOL2202/GEOL2203/GEOL2205/GGEO2233]**
GEOL3002	**Capstone: Caribbean Geology**	**3**	**1**	**3**	**GEOL2205 and any one of: [GEOL2201/GEOL2202/GEOL2203/GEOL2204/GGEO2233]**
GEOL3104	**Sedimentology & Facies Analysis**	**3**	**2**	**3**	**GEOL2202 and any one of : [GEOL2201/GEOL2203/GEOL2204/GEOL2205/GGEO2233]**

GEOL3105	**Petroleum Geology**	**3**	**1**	**3**	**GEOL2202 and any one of: [GEOL2201/GEOL2203/GEOL2204/GEOL2205/GGEO2233]**
GEOL3107	**Geophysics & Seismicity**	**3**	**1**	**3**	**GEOL2204 and any one of: [GEOL2201/GEOL2202/GEOL2203/GEOL2205/GGEO2233]**
GEOL3108	**Metallic Ores & Industrial Minerals**	**3**	**1**	**3**	**GEOL2203 and any one of: [GEOL2201/GEOL2202/GEOL2204/GEOL2205/GGEO2233]**
GGE03231	**Karst & Coastal Geomorphology**	**3**	**2**	**3**	**GEOG2231 or GEOL2202**
GGEO3232	**Climate Change in the Tropics**	**3**	**1**	**3**	**GEOG2232 or any one of, GEOL2201, GEOL2202, GEOL2203, GEOL2204, GEOL2205, or Permission of HOD**
GGEO3233	**Hydrology & Hydrological Modelling**	**3**	**1**	**3**	**GGEO2233**
GGEO3332	**Disaster Management**	**3**	**2**	**3**	**GEOG2231 and GEOG2232 or any two of GEOL2201, GEOl2202, GEOL2203, GEOL2204, GEOL2205 or Permission of HOD**
GGEO3401	**Research Project in Geosciences**	**6**	**1 and 2**	**3**	**GEOL2204 and GGEO2332 and any three of GEOG2231, GEOG2232, GEOL2201, GEOL2205,GGEO2233 Students must be pursuing the Major in Geosciences**

GEOGRAPHY AND GEOLOGY MAJORS AND MINORS

The Department of Geography and Geology (DOGG) presently offers a Major in geography with an accompanying Minor, and a Minor in human geography; a Major in geology with an accompanying Minor, and a Major in geosciences. The geography Major is available as a B.Sc. and as a BA for students in the Faculty of Humanities and Education. The Department of Geography and Geology introduced new Majors and Minors from September 2012. These will be available to students entering Level 2 who have successfully completed the new 3-credit Level 1 courses introduced in September 2011 under curriculum reform. Students who entered Level 3 in September 2012 will remain under the old regulations.

The total number of credits for the degree will be in accordance with the faculty regulations (93 credits). The Geography Major has a minimum requirement of 30 credits from Levels 2 and 3. The Geology Major has a minimum of 39 credits from Levels 2 and 3. The Geosciences Major requires a minimum of 42 credits from Levels 2 and 3. Minors have a minimum of 15 credits in accordance with faculty regulations.

Students are advised that compulsory field work in the Department of Geography and Geology is carried out on Saturdays.

MAJOR IN GEOGRAPHY

LEVEL 1 (Prerequisite-CSEC Geography (or equivalent)

GEOG1131	Human Geography 1 Population, Migration and Human Settlement
GEOG1231	Earth Environments 1 Geomorphology and Soils
GEOG1132	Human Geography 2 World Economy, Agriculture and Food
GEOG1232	Earth Environments 2 Climate and the Biosphere

LEVEL 2 (30 credits from Level 2 and Level 3, at least 15 credits should be from Level 3)

GEOG2231	Research Methods in Geography (**Compulsory)**
GEOG2131	Urban Geographies
GEOG2132	Geographies of Development
GEOG2231	Earth Surface Processes
GEOG2232	Environmental Change

GGEO2233 Water Resources
GGEO2232 Introduction to Geographical Information Systems

LEVEL 3
Compulsory
GEOG3430 Geography Research Project

And a minimum of 9 credits from
GEOG3131 Tropical Agriculture & Development
GEOG3132 Tourism Planning & Development
GEOG3331 Geography of the Caribbean
GEOG3333 Urban & Regional Planning
GEOG3334 Tropical Land Management
GGEO3231 Karst & Coastal Geomorphology
GGEO3232 Climate Change in the Tropics
GGEO3332 Disaster Management

MAJOR IN GEOLOGY

LEVEL I
GEOL1101 Earth Science 1: Earth Materials and Plate Tectonics
GEOL1102 Earth Science 2: Earth Processes and Earth History
GEOL1103 Earth Science 3: Minerals and Mineral Deposits
GEOL1104 Earth Science 4: Geological maps & Environmental Geology

LEVEL 2 (6 three credit courses from Level 2 {18 credits}, Research project {6 credits} and four other Level 3 courses {21 credits} – minimum 39 credits)

Compulsory
GEOL2204 Field Methods for Geology

And a minimum of five courses from
GEOL2201 Palaeontology
GEOL2202 Sedimentary Geology
GEOL2203 Igneous and Metamorphic Petrology
GEOL2205 Plate Tectonics and Geologic Structures
GGEO2233 Water Resources
GGEO2332 Introduction to Geographical Information Systems

LEVEL 3 (18 credits from Level 2 {including GEOL2204} and 21 credits from Level 3 courses-Total 39 credits from Level 2 and 3).

Compulsory
GEOL3100 Research Project in Field Geology
GEOL3102 Caribbean Geology

And a minimum of 4 courses from
GEOL3104 Sedimentology and Facies Analysis
GEOL3105 Petroleum Geology
GEOL3107 Geophysics and Seismicity
GEOL3108 Metallic Ores and Industrial Minerals
GGEO3332 Disaster Management
GGEO3231 Karst & Coastal Geomorphology
GGEO3232 Climate Change in the Tropics
GEOL3233 Hydrology and Hydrological Modelling

MAJOR IN GEOSCIENCES

LEVEL 1
GEOL1101 Earth Science 1: Earth Materials and Plate Tectonics
GEOL1102 Earth Science 2: Earth Processes and Earth History
GEOL1103 Earth Science 3: Minerals and Mineral Deposits
GEOL1104 Earth Science 4: Geological Maps and Environmental Geology
GEOG1131 Human Geography 1: Population, Migration and Human Settlement
GEOG1132 Human Geography 2: World Economy, Agriculture and Food
GEOG1231 Earth Environments1: Geomorphology and Soils
GEOG1232 Earth Environments 2: Climate and Biosphere

LEVEL 2
All compulsory courses (24 Credits):
GEOG2231 Earth Surface Processes
GEOG2232 Environmental Change
GEOL2201 Palaeontology and the History of Life
GEOL2202 Sedimentary Geology
GEOL2204 Field Methods for Geology
GEOL2205 Plate Tectonics
GGEO2332 Introduction to Geographic Information Systems
GGEO2233 Water Resources

LEVEL 3: A minimum of 18 credits
6 credits from the following compulsory course:
GGEO3401 Field Project in Geosciences

And a minimum of 12 credits from the following courses, at least 6 credits must be from the GGEO courses:
GEOL3104 Sedimentology and Facies Analysis
GEOL3105 Petroleum Geology
GGEO3231 Karst and Coastal Geomorphology
GGEO3232 Climate Change in the Tropics
GGEO3233 Hydrology and Hydrological Modelling
GGEO3332 Disaster Management

MINOR IN GEOGRAPHY

LEVEL 1: A minimum of 12 credits in level Geography, plus 12 credits from other subjects areas, at least 6 of which must be in the faculty

GEOG1131	Human Geography 1 Population, Migration and Human Settlement
GEOG1231	Earth Environments 1 Geomorphology and Soils
GEOG1132	Human Geography 2 World Economy, Agriculture and Food
GEOG1232	Earth Environments 2 Climate and the Biosphere

A minimum of 15 credits from Level II & III of which at least 9 credits should be from Level III, subject to course pre-requisites

LEVEL 2
GEOG2131 Urban Geographies
GEOG2132 Geographies of Development
GEOG2231 Earth Surface Processes
GEOG2232 Environmental Change
GGEO2233 Water Resources
GGEO2332 Introduction to Geographical Information Systems

LEVEL 3
GEOG3131 Tropical Agriculture & Development
GEOG3132 Tourism Planning & Development
GEOG3333 Urban & Regional Planning
GEOG3331 Geography of the Caribbean
GGEO3231 Karst & Coastal Geomorphology

GGEO3232 Climate Change in the Tropics
GGEO3332 Disaster Management

MINOR IN HUMAN GEOGRAPHY

LEVEL 1

GEOG1131 Human Geography 1 Population, Migration and Human Settlement
GEOG1132 Human Geography 2 World Economy, Agriculture and Food

A minimum of 15 credits from Level 2 & 3 of which at least 9 credits should be from Level 3, subject to course pre-requisites

LEVEL 2

GEOG2131 Urban Geographies
GEOG2132 Geographies of Development
GGEO2332 Introduction to Geographical Information Systems

LEVEL 3

GEOG3131 Tropical Agriculture & Development
GEOG3132 Tourism Planning & Development
GEOG3333 Urban & Regional Planning
GEOG3331 Geography of the Caribbean

MINOR IN GEOLOGY

LEVEL 1

GEOL1101 Earth Science 1: Earth Materials and Plate Tectonics
GEOL1102 Earth Science 2: Earth Processes and Earth History
GEOL1103 Earth Science 3: Minerals and Mineral Deposits
GEOL1104 Earth Science 4: Geological maps & Environmental Geology

LEVEL 2

2 or 3 courses from

GEOL2201 Palaeontology
GEOL2202 Sedimentary Geology
GEOL2203 Igneous and Metamorphic Petrology
GGEO2233 Water Resources

LEVEL 3

2 or 3 courses from

GEOL3104	Sedimentology and Facies Analysis
GEOL3105	Petroleum Geology
GEOL3107	Geophysics and Seismicity
GEOL3108	Metallic Ores and Industrials Minerals
GGEO3233	Hydrology and Hydrological Modelling
GGEO3332	Disaster Management

COURSE DESCRIPTION

GEOGRAPHY

GEOG1131 — **HUMAN GEOGRAPHY 1: POPULATION, MIGRATION & HUMAN SETTLEMENT**

(3 Credits) Semester 1 Level 1

Pre-requisites: Passes in at least **two** CAPE subjects and Geography at CSEC or its equivalent

Course Content: This course covers the following topics:

- Modern approaches to the study of population geography. The human and physical factors determining population distribution and dynamics; theories of population change, including Malthus' and neo-Malthusian thoughts; and the demographic transition theory. The sources of, and problems associated with, population statistics; how to measure fertility, mortality and migration; and population projection techniques. Family planning and population control efforts around the world; the status of women and its crucial role in population dynamics; major causes of death around the world, including AIDS; the role of migration in population dynamics; culture, population and the environment. Historical and contemporary perspectives on urbanization in both the industrialized world and the developing world, and theories on the geographical distribution of human settlement.

Evaluation:

- 2 hours written examination 60%
- One-hour multiple-choice review test 10%
    - Three practical assignments 20%
    - Tutorial assignments 10%

GEOG1132 **HUMAN GEOGRAPHY 2: WORLD ECONOMY, AGRICULTURE & FOOD**

(3 Credits) Semester 2 Level 1

Pre-requisites: Passes in at least two CAPE subjects and Geography at CSEC or its equivalent

Course Content: This course covers the following topics:

- The processes of economic development and globalization, and the economic interdependence of countries in the modern world. Basic theories, concepts, and methods for describing, measuring and analyzing patterns of economic and social development. The main factors that have contributed to uneven patterns of economic development, such as the distribution and exploitation of natural resources, and the process of industrialization, technological change and globalization. The section on agriculture and the food industry illustrates in depth many issues related to economic development and globalization, including the role of agribusiness in food production and food consumption, and the impacts of traditional and modern agricultural production systems on the environment. The geographical dimensions of world hunger and malnutrition in relation to the structure of the world economy and world agriculture. Prospects for future agricultural development.

Evaluation:

- 2 hours written examination 60%
- One-hour multiple-choice review test 10%
- Three practical assignments 20%
- Tutorial assignments 10%

GEOG1231 **EARTH ENVIRONMENTS 1: GEOMORPHOLOGY & SOILS**

(3 Credits) Semester 1 Level 1

Pre-requisites: Passes in at least two CAPE subjects and Geography at CSEC or its equivalent

Course Content: This course covers the following topics:

- Modern approaches to geomorphology and soil science. The main geomorphic processes in the context of endogenic and exogenic systems from a global perspective. The geomorphology section examines and describes endogenic systems and processes. The internal structure of the Earth and the geographic patterns of global relief of the solid surface in the context of plate tectonics. The relationship between global tectonics and the patterns and styles of volcanic activity. The passive control of rock type and geological structure in relation to landscape form and process. The soils section examines and describes the main exogenic systems and processes. The geographical patterns and types of rocks. Aspects of soil science from a geographical perspective through an examination of the main soil-forming factors, and analysis of physical and chemical soil-forming processes. Exogenic systems in relation to the main geomorphic agents of water, wind and ice in the context of fluvial, slope, aeolian, karst, glacial and periglacial systems.

Evaluation:

- 2 hours written examination 60%
- One-hour multiple-choice review test 10%
- Three practical assignments 20%
- Tutorial assignments 10%

GEOG1232 **EARTH ENVIRONMENTS 2: CLIMATE & THE BIOSPHERE**

(3 Credits) Semester 2 Level 1

Pre-requisites: Passes in at least two CAPE subjects and Geography at CSEC or its equivalent

Course Content: This course covers the following topics:

- A modern holistic approach to the study of the earth system. Introduction to climate science: the processes operating within the atmosphere and biosphere, including general circulation of the atmosphere, ocean-atmosphere interactions, and global climate systems. Emphasis on the impacts and consequences of human-environment interactions. Spatial and temporal variability of these processes on local, regional and global scales. The primary causes, both natural and human, and consequences of climate change and the impact of a changing climate for communities both within and outside the Caribbean region. Particular emphasis on the impacts of climate change on the biosphere, as well as their implications for agricultural systems. Introduction to the study of biogeography, focussing on the geographical features of biodiversity at different geographical scales, and reviewing ideas about ecosystem processes and vegetation disturbance and succession.

Evaluation:

- 2 hours written examination 60%
- One-hour multiple-choice review test 10%
- Three practical assignments 20%
- Tutorial assignments 10%

GEOG2131 **URBAN GEOGRAPHIES**

(3 Credits) Semester 1 Level 2

Pre-requisites: GEOG1131 and GEOG1132

Course Content: An introduction to key concepts, theories and empirical studies in the field of urban geography. The course deals with a variety of contemporary and relevant issues pertaining to urban growth and development, including patterns and processes of global urbanization; urban housing challenges and solutions; global urban consumerism; neighbourhood dynamics and changes; urban governance and social justice; cities and climate change; migration, race and ethnicity; and the built environment. The course draws upon a variety of examples and case studies, especially from the developing world.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - 2500-word project report 20%
    - Tutorial assignment 10%
    - In-course test (1 hour) 20%

GEOG2132 **GEOGRAPHIES OF DEVELOPMENT**

(3 Credits) Semester 2 Level 2

Pre-requisites: GEOG1131 and GEOG1132

Course Content: The course seeks to explain the dynamic nature of the development process and its impact on economies, societies and the environment in the context of an increasingly globalized world. It introduces relevant ideas, theories and concepts from social science disciplines, but focuses on how geographers bring spatial concepts and geographical models to bear on the theory and practice of development. It links theories and concepts with development policy through case studies. The spatial dynamics of the global economy are highlighted through the lens of economic globalization. Sections highlight world industrialization, international trade and trade liberalization, and rural development. Special emphasis is placed on the Caribbean region in relation to the problems of sustainable development in small island developing states; environmental issues such as environmental degradation and climate change; and tourism development models.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - Internet-based research report 20%
    - Tutorial assignment 10%

      One-hour In-course test 20%

GEOG2231 **EARTH SURFACE PROCESSES**

(3 Credits) Semester 1 Level 2

Pre-requisites: GEOG1231 and GEOG1232

Course Content: This course covers the following topics:

- The course examines modern approaches to the analysis and interpretation of geomorphic processes and landforms in the context of coastal, fluvial and slope systems, and provides an in-depth examination of geomorphology in tropical settings.

Evaluation:

- 2 hours written examination 50%
- Course Work:
    - Two practical assignments 10%
    - 2500-word field report 10%
    - Two 1250-word essays 10%
    - One-hour In-course test 20%

GEOG2232 **ENVIRONMENTAL CHANGE**

(3 Credits) Semester 2 Level 2

Pre-requisites: GEOG1231 and GEOG1232

Course Content: This course covers the following topics:

- An interdisciplinary approach to the study of environmental change, looking at examples of the complex interactions between human activity and the different environmental spheres (geosphere, hydrosphere, atmosphere, and biosphere). Core components include global environmental change, sea-level change, natural climate variability, anthropogenic climate change, 21st-century climate projections, and tropical forest dynamics. The course examines the primary causes, both natural and human, and the consequences and impacts of environmental change both within and outside the Caribbean region.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - Two 1500-word essays 30%
    - Two group PowerPoint presentations 20%

GEOG2331 **RESEARCH METHODS IN GEOGRAPHY**

(3 Credits) Semester 1 Level 2

Pre-requisites: GEOG1131 and GEOG1132 and GEOG1231 and GEOG1232

Course Content: This course covers the following topics:

- The course aims to provide some basic knowledge of the key aspects of the history and philosophy of geographical enquiry, and to provide the theoretical and practical skills required to develop and conduct a research project in geography. Training in the application of geographical research methods and techniques, data collection, data and statistical analysis, and the technical presentation of results. Training in how to define a research topic, how to identify relevant literature, how to prepare a research proposal, and how to present data.

Evaluation:

- Course Work: 100%
    - One-hour In-course test 25%
    - Five research skills assignments 75%

GGEO2332 **INTRODUCTION TO GEOGRAPHICAL INFORMATION SYSTEMS**

(3 Credits) Semester 2 Level 2

Pre-requisites: Two of [GEOG1131/GEOG1132/ GEOG1231/GEOG1232] or Two of [GEOL1101/GEOL1102/ GEOL1103/GEOL1104]

Course Content: This course covers the following topics:

- The course introduces students to the theory and general principles of GIS and to practical skills and hands-on experience in its use: the fundamental concepts and basic functions of a GIS; the properties of GIS maps; the structure of a GIS database; coordinate systems and map projections; methods of performing simple vector and raster spatial analysis. In lab exercises students will work with ArcMap to visualize geographic data, create maps, query a GIS database, perform spatial analysis using common analytical tools, and solve geographical problems using a systematic approach. The course introduces the core functionality of GIS software packages such as ArcMap, ArcCatalog, and ArcToolbox.

Evaluation:

- 2 hours written examination: 50%
- Course Work: 50%
  - Six laboratory assignments 30%
  - One-hour In-course test 20%

GGEO2233 **WATER RESOURCES**

(3 Credits) Semester 1 Level 2

Pre-requisites: [GEOG1231 and GEOG1232] or [GEOL1102 and GEOL1104]

Course Content: This course covers the following topics:

- An in-depth study of the hydrological cycle, evaporation/transpiration, and rainfall-runoff relationships in hydrogeology. The factors affecting evaporation and evapotranspiration from free water surfaces and soils. Different estimates and measurements of evaporation and evapotranspiration and soil moisture storage and movement. The nature and origin of different types of aquifers, their geological properties, the various types of groundwater flows to wells, flows within aquifers under steady/nonsteady conditions. Techniques of hydrogeological investigation, including drilling and pump testing. The hydraulics of surface water systems and seasonal variability of the flow pattern in streams and rivers. Flooding and drought. Special emphasis on the water resources of Jamaica and other Caribbean islands.

Evaluation:

- 2 hours written examination: 50%
- 2 hours practical examination: 30%
- 2 one-hour In-course tests 20%

GEOG3131 **TROPICAL AGRICULTURAL & DEVELOPMENT**

(3 Credits) Semester 1 Level 3

Pre-requisite: GEOG2132

Course Content: This course covers the following topics:

- **Global Change**: impacts of trade liberalization and
climate change on export agriculture and domestic food production– includes case studies. Population growth and the diffusion of agricultural innovations – contrasting models of the dynamics of agricultural change.
- **Economic and behavioural approaches to decision making among small-scale farmers in developing countries** – includes approaches to risk reduction.
- **The role of indigenous knowledge in traditional agriculture** – includes case studies based on Jamaican research.

- **Sustainable rural livelihoods and sustainable hillside farming** – includes approaches to soil conservation and land management in hillside farming systems.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - Field project report 25%
    - One 1-hour in-course test 25%

<u>GEOG3132</u> **<u>TOURISM PLANNING & DEVELOPMENT</u>**

(3 Credits) Semester 2 Level 3

Pre-requisite: GEOG2131 or GEOG2132

Course Content: This course covers the following topics:

- An overview of recreation and leisure.
- The connections between globalisation, mobility and tourism. And the growth of mass tourism.
- The urban tourism system including a classification of the main elements and its role in urban renewal.
- The goals, principles and practice of sustainable tourism including its emergence from the concept sustainable development.
- The characteristics of ecotourism and a critical assessment of selected case studies.
- A critical analysis an analytical framework for analysing the balance between resource use and sustainability in the Caribbean tourism.
- The changing approaches to tourism planning as well the main aspects on the planning process, including local community participation.
- An advanced insight into the contested nature of tourism developments and the ways that socio-political factors render some tourist spaces as zones of exclusion and marginalisation.
- Introduction to the components, goals and challenges associated with conducting an

Environmental Impact Assessment. The role of certification programmes as measures of sustainability in tourist development practices.

- The nature and outcomes of connections between the agriculture and tourism sector with specific emphasis on the experiences of Jamaica.
- The role sex tourism plays in shaping social and economic landscapes and, by extension, the identity of places.
- The concept of vulnerability from multiple perspectives including the vulnerability of the tourism industry to external shocks, natural hazards, the impact of crime and health related challenges.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - One 1-hour in-course test 20%
    - Tourism development plan 20%
    - Multimedia presentation 5%
    - Tutorial essay 5%

<u>GEOG3331</u> **<u>GEOGRAPHY OF THE CARIBBEAN</u>**

(3 Credits) Semester 1 Level 3

Pre-requisites: Any Three of [GEOG2131, GEOG2132, GEOG2231, GEOG2232]

Course Content: This course covers the following topics:
Introduction to Caribbean Geography
The Caribbean Environment
The Caribbean as a Social and Economic Space
Morbidity and Mortality: Geographical Dimensions of Caribbean Health

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%

  One 1-hour in-course test 20%
  Project 30%

GEOG3333 **URBAN & REGIONAL PLANNING**
(3 Credits) Semester 2 Level 3

Pre-requisite: GEOG2131

Course Content: This course covers the following topics:

- Introduction to Urban & Regional Planning
- History and Evolution of Planning in Britain
- The Seers
- Planning in the Americas
- Theories of Planning
- Water and Sanitation
- Strategies for Housing the Urban Poor
- The Global Urban Energy Crisis
- Urban Safety and Security
- Adapting Cities to Climate Change

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
- One 1-hour in-course test 15%
- Written tutorial assignment 25%
- Tutorial multimedia presentation 10%

GEOG3334 **TROPICAL LAND MANAGEMENT**
(3 Credits) Semester 1 Level 3

Pre-requisites: GEOG2231, GEOG2232 and GEOG2132

Course Content: This course covers the following topics:

- Soil Formation, Weathering Processes and Products in the Humid Tropics.
- Humid Tropical Soils and Land-Use Problems Semi-Arid Tropical Soils and Land-Use Problems.
- Desertification. Slope Failure and Tropical Land Management. Soil Erosion and Tropical Land Management.
- Land Degradation. Land Classification and Land Capability.

- Land Management and Environmental Change.

Evaluation:

- 2 hours written examination 50%
- Course Work 50%
    - Field report: 20%
    - Practical exercises: (7.5% each) 15%
    - Tutorial essay assignment: 15%

GEOG3430 **GEOGRAPHY RESEARCH PROJECT**

(6 Credits) Year-Long Level 3

Pre-requisites: GEOG2331 and GGEO23321, and at least two of: GEOG2131, GEOG2132, GEOG2231, GEOG2232

Course Content: The course involves a series of steps in which the student progress through the various stages of the formulation of a research project, the execution of the project and presentation of results. At the first stage, students must complete a research proposal based on a literature search. The proposal involves the formulation of a research question, a statement of research design and methodology and includes details of any sampling methods, laboratory techniques and methods of analysis to be used. The proposal is assessed and the proposal must satisfy the assessors before the student can proceed to the next stage. At the second stage, the student is assigned to a supervisor who assists with the fine-tuning of the research design and methodology, before students proceeds to the field data collection stage. A third stage involves the submission of progress report to the supervisor, and the report includes an indication of a work plan to complete the data analysis and write up. The final stages of the course are the formal graded assessment of the project, and involve a multi-media presentation of the research results, and the submission of a dissertation.

Evaluation:

- Project Report: (dissertation) 80%
- In-course assessment: 20%

Comprising:

- Project proposal: 0% (necessary to continue but zero-rated)

- Progress report: 0% (necessary to continue but zero-rated)
- Oral presentation: 20%

GGEO3231 **KARST & COASTAL GEOMORPHOLOGY**
(3 Credits) Semester 2 Level 3

Pre-requisites: GEOG2231 or GEOL2202

Course Content: This course covers the following topics:

- Karst Rocks and Material Properties. Karst Processes and Controls. Karst Landform Systems. Applied Karst Geomorphology.
- The Geomorphic Legacy of Sea-level Change and Paleo-Coastal Environments. Coastal Forces and Processes. Coastal Landform Systems. Applied Coastal Geomorphology.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - Field project report: 20%
    - Tutorial essay assignment: 10%
    - One 1-hour in course test: 20%

GGEO3232 **CLIMATE CHANGE IN THE TROPICS**
(3 Credits) Semester 1 Level 3

Pre-requisites: GEOG2232 or any one of GEOL220, GEOL2202, GEL2203, GEOL2204, GEOL2205or Permission of HOD (Other Majors)

Course Content: This course covers the following topics:

- A theoretical and practical basis for understanding present-day tropical environments and the causes of global environmental change, as well as for assessing the scale of human interference in natural environmental processes.

Evaluation:

- 2 hours written examination 50%
- Course Work 50%
    - One laboratory report (about 2500 words): 20%

- One critical review (about 2500words): 20%
- One oral presentation: 10%

GGEO3233 **HYDROLOGY & HYDROLOGICAL MODELLING**

(3 Credits) Semester 2 Level 3

Pre-requisites: GGEO2233

Course Content: This course covers the following topics:

- Spatial and temporal variations in precipitation. Creation of rainfall maps using isohyetal, arithmetic mean and Theissen polygon method.
- Statistical methods for calculating return periods for rainfall and flood data.
- Hydrograph separation using computational methods and calculation of baseflow, inter and overland flow. Types of flooding and flood hazards in Jamaica. Climate change and hydrological hazards.
- Hydrologic Simulation models, steps in watershed modelling, description of models principles, mainly HEC HMS models Flood plain hydraulics – principles and concepts of HEC RAS (1D) model including case studies.
- Hydraulic properties of aquifers and their methods of determination. Groundwater flow calculations and flow variation under different climatic and non-climatic conditions.
- Geophysical and geological investigations for groundwater sources. Groundwater contamination and transport model. Groundwater wells: types and methods of drilling.
- Water resources of the Caribbean, with special emphasis on Jamaica. Climate change and challenges in the water sector: Jamaica and the Caribbean.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
- Laboratory Project 40%
- Field Trip Report 10%

GGEO3332 **DISASTER MANAGEMENT**

(3 Credits) Semester 2 Level 3

Pre-requisites: GEOG2231and GEOG2232, or any two of: GEOL2 or Permission of HOD

Course Content: This course covers the following topics:

- An introduction to the basic principles and techniques in disaster management.
- A study of theory, hazards, vulnerability, response capability, risk Evaluation, disaster scenarios, disaster management, preparedness, prevention, emergency response, and simulation.
- Basic concepts of geology, geomorphology, tectonics and geophysics in the study of natural hazards, with special reference to the Caribbean.
- Hazards and risks related to volcanic activity, earthquakes, landslides, hydrometeorological processes; flooding and hurricanes.
- Hazard mapping. Approaches to natural hazard loss-reduction.

Evaluation:

- 2 hours written paper 50%
- Course Work 50%
- Three practical exercises (5% each) 15%
- Fieldwork (field notebook and written report 15%
- Multimedia presentation (team presentation) 10%
- Project Report (individual) 10%

GGEO3401 **RESEARCH PROJECT IN GEOSCIENCES**

(6 Credits) Semester2 Level 3

Pre-requisites: GEOL2204 and GGEO2332 and any Three of:

[GEOG2231, GEOG2232, GEOL2201, GEOL2202, GEOL2205, GGEO2233] Students must be registered for the Geosciences Major.

Course Content: This course covers the following topics:
An approved research project in the field of Geosciences is undertaken in the summer preceding the final year of the programme. The course involves the formulation of a research project, the execution of the project and presentation of results. The final outcome involves a multi-media presentation of the research results, and the submission of a dissertation in Semester 2.

Evaluation:

- Project Report: (dissertation) 80%
- In-course assessment: 20%
- Comprising:
    - Project proposal: 0% (necessary to continue but zero-rated)
    - Progress report: 0% (necessary to continue but zero-rated)
    - Oral presentation: 20%

GEOLOGY

GEOL1101 **EARTH SCIENCE 1: EARTH MATERIALS & PLATE TECTONICS**

(3 Credits) Semester 1 Level 1

Pre-requisites: Passes in at least two science subjects at CAPE or equivalent

Course Content: This course covers the following topics:

- An introduction to the study of earth materials and earth systems, giving an overview of how basic earth processes work and how rocks and minerals are formed. Introduces topics such as the structure of the Earth, its internal processes, and basic earth materials, minerals and rocks. A central focus is on plate tectonics, now seen as the unifying concept linking earth processes and materials in the rock cycle. Practical instruction will provide the basic skills of mineral and rock identification, and will also cover volcanic and seismic processes on broader regional and global scales.

Evaluation:

- 2 hours theory examination 50%
- 2 hours practical examination 30%
- One-hour In-course test 10%
- Field trip (Evaluation of field questionnaire) 5%
- Two tutorial assignments 5%

GEOL1102 **EARTH SCIENCE 2: EARTH PROCESSES & EARTH HISTORY**

(3 Credits) Semester 1 Level 1

Pre-requisites: As for GEOL1101

Course Content: This course covers the following topics:

- An introduction to the physical and chemical processes that operate within different environments and produce a range of geomorphological features on the Earth. Introductory aspects of physical geology, including: weathering and erosion; landforms (rivers, slopes, coastlines, arid lands, glaciated environments); and the use of topographic maps. An appreciation of the processes acting on the Earth's surface and how they can be used to interpret Earth history as critical guide to understanding the global distribution of rocks, geological features and earth resources. An introduction to historical geology – origin of the Earth, origin of life on Earth, the geological timescale – with an emphasis on using present geological processes to interpret the past.

Evaluation:

- 2 hours theory examination 50%
- 2 hours practical examination 30%
- Course Work: 10%
    - Field trip exercise 5%
    - Two tutorial assignments 5%

GEOL1103 **EARTH SCIENCE 3: MINERALS & MINERAL DEPOSITS**

(3 Credits) Semester 2 Level 1

Pre-requisites: As for GEOL1101

Course Content: This course covers the following topics:

- An introduction to crystal chemistry, crystallography, optical mineralogy and the geology of mineral deposits. The course is designed to develop the theoretical knowledge and critical practical expertise in observing, analyzing, describing and classifying minerals and rocks, using a hand lens to investigate hand specimens and a petrographic microscope to investigate thin sections. These basic skills are essential for the identification of ore and industrial minerals, as well as in the investigation of sedimentary, igneous and metamorphic rocks that will be introduced in advanced level courses.

Evaluation:

- 2-hour written examination 50%
- 2-hour practical examination 30%
- One-hour In-course examination 11%
- Three tutorial assignments 9%

GEOL1104 **EARTH SCIENCE 4: GEOLOGICAL MAPS & ENVIRONMENTAL GEOLOGY**

(3 Credits) Semester 2 Level 1

Pre-requisites: As for GEOL1101

Course Content: This course covers the following topics:

- An introduction to structural geology, geological maps and environmental geology. In structural geology, the student will learn how to describe measure and analyze planar and linear features in rocks, including folds, faults and fabrics. Geological map interpretation will allow the recognition of how rock relationships are depicted on maps, and practical classes will concentrate on the construction of geological cross-sections and the interpretation of geological histories. In environmental geology, the student will be introduced to the natural and anthropogenic physical and chemical factors that affect the environment, with topics including climatic change and the combustion of fossil fuels; ocean pollution; toxic and radioactive waste disposal; land use management; geological hazards; water resources; and energy resources.

Evaluation:

• 2 hours theory examination	50%
• Six laboratory exercises	36%
• Two tutorial assignments	5%
• Field trip (Evaluation of field notebook)	9%

GEOL2201 **PALAEONTOLOGY & THE HISTORY OF LIFE**

(3 Credits) Semester 2 Level 2

Pre-requisites: [GEOL1101 and GEOL1102] or [BIOL1262 and BIOL1263]

Course Content: This course covers the following topics:

- An overview of the most important fossil groups, and an introduction to modern palaeontological methods and research. The practical part of the course covers the fundamentals of fossilization and taphonomy and the morphology of common fossil groups within the major phyla. The lecture portion introduces the most important topics in palaeobiology, evolution, the species concept in palaeontology, phylogenetics, speciation and extinction. There will also be an overview of the major patterns in life history, covering large-scale biotic radiations and crises and their linkages to global environmental change.

Evaluation:

- 2 hours written paper 50%
- 2 hours practical exam 20%
- One-hour In-course test 20%
- 1200-1500 word tutorial essay 10%

GEOL2202 **SEDIMENTARY GEOLOGY**
(3 Credits) Semester 1 Level 2

Pre-requisites: GEOL1101 and GEOL1102

Course Content: This course covers the following topics:

- The course provides the basic skills necessary to understand sedimentary rocks. Classification schemes for clastic and carbonate sedimentary rocks based on grain size, grain type and grain fabric, and their use in the field, in hand specimens and under the microscope. Sedimentary structures (erosional, depositional, post-depositional). Diagenetic features of rocks, and diagenetic pathways using sedimentary fabrics, stable isotopes and petrography.

Evaluation:

- 2 hours written paper 50%
- Four practical assignments 40%
- Field project 10%

GEOL2203 **PETROLOGY OF IGNEOUS & METAMORPHIC ROCKS**
(3 Credits) Semester 1 Level 2

Pre-requisites: GEOL1101 and GEOL1103

Course Content: This course covers the following topics:

- The course builds on the two major rock types (igneous and metamorphic) and rock-forming mineral identification introduced in GEOL1101 and GEOL1103, in the context of the mineralogy, chemical composition, petrology, field geology, tectonics (at the macro- and micro-scale), structure, and historical genesis of these rocks.

Evaluation:

• 2 hours written paper	50%
• 2 hours practical exam	20%
• Two one-hour In-course tests	20%
• Assignment/project	10%

GEOL2204 **FIELD TECHNIQUES FOR GEOLOGY**

(3 Credits) Semester 2 Level 2

Pre-requisites: GEOL1101 and GEOL1102 and GEOL1104

Course Content: This course covers the following topics:

- Various techniques for collecting field data in geology, including geological mapping, collection of structural data, collection of data in a field notebook, and sedimentary logging. The course will distinguish between data (observation and recording of information) and interpretation of data. It will involve a 5-day residential field course and one-day field trips.

Evaluation:

• Geological field map, cross-sections, etc.	40%
• Two field notebook reports	20%
• Eight laboratory exercises	40%

GEOL2205 **PLATE TECTONICS & GEOLOGICAL STRUCTURES**

(3 Credits) Semester 2 Level 2

Pre-requisites: GEOL1101 and GEOL1102 and GEOL1104

Course Content: This course covers the following topics:

- The course builds on the Level 1 course in plate tectonics and sets igneous, metamorphic and sedimentary rocks within their geological context. It will look at igneous suites and their geochemical characterization, and how this can be used to identify their plate tectonic setting.

Metamorphic rocks will be used to infer geological indicators. The course will also build on the student's understanding of structural geology from GEOL1104, and explore the different tectonic styles found in different parts of the Caribbean and their importance to geological resources.

Evaluation:

- 2 hours written examination 50%
- 2500-word field report 10%
- Eight laboratory exercises 40%

GGEO2332 **INTRODUCTION TO GEOGRAPHICAL INFORMATION SYSTEMS**

(3 Credits) Semester 2 Level 2

Pre-requisites: Two of: [GEOG1131/GEOG1132/ GEOG1231/GEOG1232] OR Two of: [GEOL1101/GEOL1102/GEOL1103/GEOL1104]

Course Content: This course covers the following topics:

- The course introduces students to the theory and general principles of GIS and to practical skills and hands-on experience in its use: the fundamental concepts and basic functions of a GIS; the properties of GIS maps; the structure of a GIS database; coordinate systems and map projections; methods of performing simple vector and raster spatial analysis. In lab exercises students will work with ArcMap to visualize geographic data, create maps, query a GIS database, perform spatial analysis using common analytical tools, and solve geographical problems using a systematic approach. The course introduces the core functionality of GIS software packages such as ArcMap, ArcCatalog, and ArcToolbox.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
  - Six laboratory assignments 30%
  - 1 hours In-course test 20%

GGEO2233 **WATER RESOURCES**

(3 Credits) Semester 1 Level 2

Pre-requisites: [GEOG1231 and GEOG1232] OR [GEOL1102 and GEOL1104]

Course Content: This course covers the following topics:

An in-depth study of the hydrological cycle, evaporation/transpiration, and rainfall-runoff relationships in hydrogeology. The factors affecting evaporation and evapotranspiration from free water surfaces and soils. Different estimates and measurements of evaporation and evapotranspiration and soil moisture storage and movement. The nature and origin of different types of aquifers, their geological properties, the various types of groundwater flows to wells, flows within aquifers under steady/non-steady conditions. Techniques of hydrogeological investigation, including drilling and pump testing. The hydraulics of surface water systems and seasonal variability of the flow pattern in streams and rivers. Flooding and drought. Special emphasis on the water resources of Jamaica and other Caribbean islands.

Evaluation:

- 2-hours written examination 50%
- 2-hours practical examination 30%
- Two 1 hour In-course tests 20%

GEOL3100 **RESEARCH PROJECT IN FIELD GEOLOGY**

(6 Credits) Semester 2 Level 3

Pre-requisites: GEOL2204 and any three of [GEOL2201, GEOL2202, GEOL2203, GEOL2204, GEOL2205, GGEO2233]

Course Content: This course covers the following topics:

- A field-based research project to be undertaken in the summer preceding the final year of the programme, followed by laboratory analyses and report writing. The completed project report and an oral presentation will be required in Semester 2 of the final year.

Evaluation:

- Field and laboratory notes: 10%
- Multimedia presentation: 10%
- Technical report: 80%

GEOL3102 **CAPSTONE: CARIBBEAN GEOLOGY**

(3 Credits) Semester 1 Level 3

Pre-requisites: GEOL2205 and any one of: [GEOL2201, GEOL2202, GEOL2203, GEOL2204, GGEO2233]

Course Content: This course covers the following topics:

- Geological evolution of the Caribbean; geology of Caribbean mainland and island countries, and the Caribbean seafloor.

Evaluation:

- 2 hours written examination 70%
- One seminar presentation 30%

GEOL3104 **SEDIMENTOLOGY & FACIES ANALYSIS**

(3 Credits) Semester 2 Level 3

Pre-requisite: GEOL2202 and any one of: [GEOL2201, GEOL2203, GEOL2204, GEOL2205, GGEO2233]

Course Content: This course covers the following topics:

- Advanced sedimentology; facies analysis.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
- Four Laboratory Practicals (10% each) 40%
- Field Notebook 10%

GEOL3105 **PETROLEUM GEOLOGY**

(3 Credits) Semester 1 Level 3

Pre-requisites: GEOL2202 and any one of: [GEOL2201, GEOL2203, GEOL2204, GEOL2205, GGEO2233]

Course Content: This course covers the following topics:

- The concept of the Petroleum System. Source rock formation and evaluation. Chemical components of petroleum. Primary and secondary migration of hydrocarbons. Reservoirs traps and seals. Searching for hydrocarbons. Geophysical methods used in the search for hydrocarbons. Hydrocarbon provinces of the Caribbean and the Gulf of Mexico.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - Four Laboratory Practical 40%
    - Field Notebook 10%

GEOL3107 **GEOPHYSICS & SEISMICITY**

(3 Credits) Semester 1 Level 3

Pre-requisites: GEOL2204 and any one of: [GEOL2201, GEOL2202, GEOL2203, GEOL2205, GGEO2233]

Course Content: This course covers the following topics:

- Introduction to Geophysics. Gravity Methods. Geomagnetics. Applied Seismology.
- Electrical Resistivity Methods. Electromagnetic Methods. Ground-Penetrating Radar. Case studies: Overview of geophysical techniques in engineering, environmental geology, oil exploration, archaeological studies and forensic applications.
- A field trip in which students will use Electrical Resistivity, Ground Penetrating Radar and Seismic Refraction survey techniques to identify subsurface geology, aquifers, lithological boundaries, and other engineering and environmental issues.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - In-course test 20%

- Five Laboratory Assignments (4% each) 20%
- Field Report 10%

GEOL3108 **METALLIC ORES & INDUSTRIAL MINERALS**

(3 Credits) Semester 1 Level 3

Pre-requisites: GEOL2203 and any one of: [GEOL2201, GEOL2202, GEOL2203, GEOL2204, GGEO2233]

Course Content: This course covers the following topics:

- Definitions for resources and reserves. Abundances of metals in the Earth's crust.
- Overview of the natural processes that produce metallic mineral deposits.
- The metallic mineral potential of Jamaica and the Caribbean.
- How a geologist contributes to the development of metallic mineral occurrences: field mapping, sampling, core logging, data/information interpretation from field and laboratory, report writing.
- Rare Earth Elements.
- Construction materials (building stones, aggregates, cement).
- Industrial minerals. Resource assessments for metallic and industrial minerals.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - One 1 hour- seminar and a 1 hour class discussion 30%
    - Laboratory exercise on mineral identification 10%
    - Laboratory exercise on resource assessment 10%

GGEO3231 **KARST & COASTAL GEOMORPHOLOGY**

(3 Credits) Semester 2 Level 3

Pre-requisites: GEOG2231 or GEOL2202

Course Content: This course covers the following topics:

- Karst Rocks and Material Properties. Karst Processes and Controls. Karst Landform

Systems. Applied Karst Geomorphology.

- The Geomorphic Legacy of Sea-level Change and Paleo-Coastal Environments. Coastal Forces and Processes. Coastal Landform Systems. Applied Coastal Geomorphology.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
  - Field project report: 20%
  - Essay assignment: 10%
  - One 1-hour in course test: 20%

GGEO3232 **CLIMATE CHANGE IN THE TROPICS**

(3 Credits) Semester 1 Level 3

Pre-requisites: GEOG2232 or any one of GEOL220, GEOL2202, GEL2203, GEOL2204, GEOL2205or Permission of HOD (Other Majors)

Course Content: This course covers the following topics:

- A theoretical and practical basis for understanding present-day tropical environments and the causes of global environmental change, as well as for assessing the scale of human interference in natural environmental processes.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
  - One laboratory report (about 2500 words) 20%
  - One critical review (about 2500words) 20%
  - One oral presentation: 10%

GGEO3233 **HYDROLOGY & HYDROLOGICAL MODELLING**

(3 Credits) Semester 2 Level 3

Pre-requisites: GGEO2233

Course Content: This course covers the following topics:

- Spatial and temporal variations in precipitation. Creation of rainfall maps using isohyetal, arithmetic mean and Theissen polygon method. Statistical methods for calculating return periods for rainfall and flood data. Hydrograph separation using computational methods and calculation of baseflow, inter and overland flow.
- Types of flooding and flood hazards in Jamaica.
- Climate change and hydrological hazards. Hydrologic Simulation models, steps in watershed modelling, description of models, principles, mainly HEC HMS models. Floodplain hydraulics – principles and concepts of HEC RAS (1D) model including case studies.
- Hydraulic properties of aquifers and their methods of determination. Groundwater flow calculations and flow variation under different climatic and non-climatic conditions. Geophysical and geological investigations for groundwater sources.
- Groundwater contamination and transport model. Groundwater wells: types and methods of drilling. Water resources of the Caribbean, with special emphasis on Jamaica. Climate change and challenges in the water sector: Jamaica and the Caribbean.

Evaluation:

- 2 hours written examination 50%
- Course Work: 50%
    - Laboratory Project 40%
    - Field Trip Report 10%

GGEO3332 **DISASTER MANAGEMENT**

(3 Credits) Semester 2 Level 3

Pre-requisites: GEOG2231and GEOG2232, or any two of: GEOL2 or Permission of HOD

Course Content: This course covers the following topics:

- An introduction to the basic principles and techniques in disaster management. A study of theory, hazards, vulnerability, response capability, risk Evaluation, disaster scenarios, disaster management, preparedness, prevention, emergency response, and simulation.
- Basic concepts of geology, geomorphology, tectonics and geophysics in the study of natural hazards, with special reference to the Caribbean.
- Hazards and risks related to volcanic activity, earthquakes, landslides, hydrometeorological processes; flooding and hurricanes.
- Hazard mapping. Approaches to natural hazard loss-reduction.

Evaluation:

- 2 hours written paper 50%
- Course Work: 50%
  - Three practical exercises (5% each) 15%
  - Fieldwork (field notebook and written report) 15%
  - Multimedia presentation (team presentation) 10%
  - Project report (individual) 10%

GGEO3401 **RESEARCH PROJECT IN GEOSCIENCES**

(6 Credits) Semester2 Level 3

Pre-requisites: GEOL2204 and GGEO2332 and any Three of: [GEOG2231, GEOG2232, GEOL220, GEOL2202, GEOL2205, GGEO2233] Students must be registered for the Geosciences Major.

Course Content: This course covers the following topics:
An approved research project in the field of Geosciences is undertaken in the summer preceding the final year of the programme. The course involves the formulation of a research project, the execution of the project and presentation of results. The final outcome involves a multi-media presentation of the research results, and the submission of a dissertation in Semester 2.

Evaluation:

- Project Report: (dissertation) 80%
- In-course assessment: 20%

- Comprising:
    - Project proposal: 0% (necessary to continue but zero-rated)
    - Progress report: 0% (necessary to continue but zero-rated)
    - Oral presentation: 20%

Department OF Life Sciences

BSc.

Biology with Education
Environmental Biology
Experimental Biology

MAJOR

Animal Biology
Plant Biology
Horticulture
Marine Biology
Terrestrial and Freshwater Ecology

MINOR

Animal Biology
Coastal Ecosystems
Plant Biology
Terrestrial and Freshwater Ecology

UNDERGRADUATE COURSES OFFERED BY THE DEPARTMENTOF LIFE SCIENCES					
CODES	TITLES	CREDIT	SEMESTER OFFERED	LEVEL	PRE-REQUISITES
PRELIMINARY LEVEL					
BIOL0011	Preliminary Biology I	6	1	0	CSEC Biology or equivalent
BIOL0012	Preliminary Biology II	6	2	0	CSEC Biology or equivalent
LEVEL 1					
BIOL1017 AND BIOL1018	Cell Biology Molecular Biology and Genetics	3 3	1	1	A pass in one of the following: Preliminary Biology I and II (BL05A/BIOL0011) and BL05B/BIOL0012) or CAPE Unit 1 & 2 ('A' level) Biology or equivalent
BIOL1262 AND BIOL1263	Living Organisms I: Living Organisms II:	3 3	2	1	A pass in one of the following: Preliminary Biology I and II (BL05A/BIOL0011) and BL05B/BIOL0012) or CAPE Unit 1 & 2 ('A' level) Biology or equivalent

LEVEL 2 AND 3

Life Sciences Advanced courses are all 3 credits and will be offered as outlined in the tables below.

Pre-requisites for all Life Sciences Level 2 courses are:

BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, **and** a minimum of 24 credits from Level 1, 18 of which must be FST courses.

LEVEL 2 COURSES (10 courses of 3 credits each available as of 2011/12 Academic Year)

<table>
<tr><th colspan="4">ADVANCED COURSES OFFERED BY THE LIFE SCIENCES DEPARTMENT</th></tr>
<tr><th></th><th>6 Week Courses</th><th>12 Week Courses</th><th>6 Week Courses</th></tr>
<tr><td>Semester 1
Week 1-6</td><td>BOTN2401
Plant Form and Systematics</td><td rowspan="2">BIOL2401
Research Skills and Practices in Biology</td><td>BIOL2407- Biological Evolution</td></tr>
<tr><td>Semester 1
Week 7-12</td><td>BIOL2406
Eukaryotic Microbiology</td><td>BIOL2402- Fundamentals of Biometry</td></tr>
<tr><td>Semester 2
Week 1-6</td><td>BIOL2404
Molecular & Population Genetics</td><td rowspan="2">BIOL2403
Principles of Ecology</td><td>ZOOL2403- Maintenance Systems in Animals</td></tr>
<tr><td>Semester 2
Week 7-12</td><td>BOTN2402
Physiology of Plants</td><td>ZOOL2404- Coordination and Control in Animals</td></tr>
</table>

BIOL2408- Diving for Scientists. Courses in **bold font** are core to all Life Sciences Programmes, Majors and Minors.

LEVEL 3 COURSES (Available as of 2014/15 Academic Year)						
A1 **Tues/Thurs** **Mon/Fri**	**A2** **Tues/Thurs** **Mon/Fri**	**B1** **Friday/** **Monday**	**B2** **Friday/** **Monday**	**C1** **Monday**	**C2** **Mon/** **Fri**	**EVENINGS** **Tues/Wed**
BOTN3405 **Plant Eco-Physiology**	**ZOOL3407** **Human Biology**	**ZOOL3403** **Entomology**	**ZOOL3409** **Aquaculture**	**BIOL3407** **Oceanography**	**BIOL3403** **The Biology of Soil**	**AGSL2401** **Management of Soils**
BOTN3402 **Plant Breeding**	**ZOOL3405** **Vertebrate Biology**	**ZOOL3404** **Parasitology**	**BOTN3406** **Tropical Forest**	**BIOL3408** **Coastal Ecosystems**	**BOTN3403** **Fundamentals of Horticulture**	**AGSL3001** **Irrigation and Drainage**
TBA	**ZOOL2402** **Animal Physiology**	**ZOOL3406** **Immunology**	**BIOL3406** **Freshwater Biology**	**ZOOL3408** **Sustainable Use of Fish. Resources**	**BIOL3404** **Virology**	**AGCP3407** **Postharvest Technology**
BOTN3401 **Principles of Plant Biotechnology**	**BIOL3410** **Water Pollution**	**BIOL3405** **Pest Ecology& Management**	**BIOL3400** **Issues in Conservation Biology**	**BIOL3409** **Caribbean Coral Reefs**	**BOTN3404** **Economic Botany**	**AGCP3406** **Fruit Crop Production**
AGBU3008-Internship; AGBU3012-Research Project; BIOL3412-Internship; BIOL3413- Biology Project						

BSc. BIOLOGY WITH EDUCATION
(63 Advanced Credits)

Programme Overview

This Option is designed to provide educators with a solid Foundation in selected aspects of plant and animal science and expose students to the practice of science pedagogy. The focus is on Biology with less emphasis on education courses as it is aimed at students lacking in Biology but who, through experience or previous courses, had exposure to the requisite teaching skills.

Programme Outline

LEVEL 1: A minimum of 24 credits from Level 1, 18 of which must be FST courses and must include:

Semester 1

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics

Semester 2

BIOL1262	Living Organisms I
BIOL1263	Living Organisms II

The FST Level 1 courses Semester 1:MICR1010-Introductory, Microbiology and Molecular Biology (3 credits) and Semester 2: BIOC1020-Cellular Biochemistry (3 credits) are highly recommended.

LEVEL 2 63 credits which must include:

Semester 1

BIOL2401	Research skills and practices in Biology
BIOL2402	Fundamentals of Biometry
BIOL2407	Biological Evolution
BOTN2401	Plant Form and Systematics
BIOL2405	Eukaryotic Microbiology

Semester 2

BIOL2403	Principles of Ecology
BIOL2404	Molecular & Population Genetics
BOTN2402	Physiology of Plants
ZOOL2403	Maintenance Systems in Animals
ZOOL2404	Coordination and Control in Animals

(All life Sciences Level 1 and 2 courses are worth 3 credits each)

EDUCATION COURSES

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

BSc. ENVIRONMENTAL BIOLOGY
(63 Advanced Credits)

Programme Overview

The BSc in Environmental Biology is designed to provide a detailed understanding of the concepts, strategies and practices available to scientifically investigate and analyse species, communities and ecosystems towards the successful monitoring, management and development of strategies for sustainable use of these systems.

Programme Outline: Modified for 2012/2013

The **BSc in Environmental Biology** cannot be taken with any other major or minor because of the number of credits required which are as follows:

LEVEL 1: A minimum of **24** credits from Level 1, 18 of which must be FST courses and must include:

BIOL1017 Cell Biology
BIOL1018 Molecular Biology and Genetics
BIOL1262 Living Organisms I
BIOL1263 Living Organisms II

LEVEL 2: A total of **30**credits from Level 2 which must include:

BIOL2401 Research skills and Practices in Biology
BIOL2402 Fundamentals of Biometry
BIOL2403 Principles of Ecology
BIOL2404 Molecular & Population Genetics
ZOOL2403 Maintenance Systems in Animals
ZOOL2404 Coordination and Control in Animals
BIOL2407 Biological Evolution3
BOTN2401 Plant Diversity and Systematics
BOTN2402 Physiology of Plants3
BIOL2405 Eukaryotic Microbiology3

LEVEL 3: A total of **33** credits from the following:

BIOL3407 Oceanography
BIOL3408 Coastal Ecosystems
BIOL3409 Caribbean Coral Reefs
ZOOL3408 Sustainable use of Fishable Resources
ZOOL3409 Aquaculture
BOTN3407 Tropical Forest Ecology
BIOL3406 Freshwater Biology
ZOOL3403 Entomology
ZOOL3400 Issues in Conservation Biology
BOTN3405 Plant Eco-physiology
AGCP3405 Landscape and Turf Grass Production
BIOL3413 Biology Project OR BIOL3412 Internship

BSc. EXPERIMENTAL BIOLOGY
(63 Advanced Credits)

Programme Overview

The BSc Experimental Biology was previously offered as an Option in Experimental Biology. It is designed to expose students to a wide range of laboratory based courses which reflect the variety of specializations available within the subject of Biology. These include areas as diverse as Plant Biotechnology, Parasitology and Vertebrate Biology. The programme is intended to appeal to those students seeking a degree which emphasizes a laboratory-based experimental approach to Biology with concomitant expertise in a wide range of laboratory techniques.

Programme Structure and Content

The BSc in Experimental Biology is developed primarily around existing courses from the Department of Life Sciences and benefits from a revised third year of three credit courses. This has allowed the addition of five new courses into the final year curriculum. New courses are, in addition, presented herewith. No other major or minor is available in conjunction with the BSc Experimental Biology as it represents a complete degree.

The course requirements and structure are as tabulated below: The BSc in Experimental Biology cannot be taken with any other major or minor because of the number of credits required which are as follows:

LEVEL 1: A minimum of 24 credits from Level 1, 18 of which must be FST courses and must include:

BIOL1017 Cell Biology
BIOL1018 Molecular Biology and Genetics
BIOL1262 Living Organisms I
BIOL1263 Living Organisms II

LEVEL 2: A total of **30** credits from Level 2

BIOL2401 Research skills and practices in Biology
BIOL2402 Fundamentals of Biometry
BIOL2403 Principles of Ecology
BIOL2404 Molecular & Population Genetics
ZOOL2403 Maintenance Systems in Animals
ZOOL2404 Coordination and Control in Animals
BIOL2407 Biological Evolution
BOTN2401 Plant Diversity and Systematics
BOTN2402 Physiology of Plants
BIOL2405 Eukaryotic Microbiology

LEVEL 3: At least 33 credits of final year courses chosen from the three groups of courses below with a minimum of 3 credits from any one group.

GROUP A
BIOL3404 Virology BIOL3405 Pest Ecology and Management BIOL3402 Biology of Fungi** BIOL3403 The Biology of Soil
GROUP B
BOTN3401 Principles of Plant Biotechnology BOTN3402 Plant Breeding BOTN3403 Fundamentals of Horticulture BOTN3404 Economic Botany BOTN3405 Plant Eco-physiology
GROUP C
ZOOL3403 Entomology ZOOL3404 Parasitology ZOOL3407 Human Biology ZOOL3405 Vertebrate Biology ZOOL3406 Immunology
Plus BIOL3413 Biology Project OR BIOL3412 Internship

MAJOR IN ANIMAL BIOLOGY
(39 Advanced Credits)

Programme Overview

Animal Biology is the study of the huge variety of animal life on Earth. As a Department of Life Sciences with a central focus on the biotic environment there is a need to adopt a theoretical and practical approach to the biology of animals, how animals integrate into the environment, and how environmental change may affect animal populations in the future. The major examines the evolutionary origins of the various groups of animals, their structure, physiology, behaviour, interspecific associations, defence mechanisms, ecology and conservation.

Programme Outline

LEVEL 1: A minimum of 24 credits from Level 1 courses, and must include:

BIOL1017 Cell Biology
BIOL1018 Molecular Biology and Genetics
BIOL1262 Living Organisms I
BIOL1263 Living Organisms II

LEVEL 2 A minimum of 21 credits which must include:

BIOL2401	Research skills and practices in Biology
BIOL2407	Biological Evolution
BIOL2403	Principles of Ecology
BIOL2404	Molecular & Population Genetics
ZOOL2403	Maintenance Systems in Animals
ZOOL2404	Coordination and Control in Animals

LEVEL 3 A minimum of 18 credits which must include:

ZOOL3403	Entomology
ZOOL3404	Parasitology
ZOOL3405	Vertebrate Biology
ZOOL2402	Animal Physiology
ZOOL3410	Advanced Topics in Animal Science

And 3 credits from any of the following:

ZOOL3406	Immunology
BIOL3404	Virology
BIOL3405	Pest Ecology and Management

MINOR IN ANIMAL BIOLOGY
(15 Advanced Credits)

Programme Overview

The minor provides general training in animal biology in the areas of ecology, genetics and evolution, cellular/molecular biology and physiology, systematics and morphology, invertebrate and vertebrate organisms.

Programme Outline

LEVEL 1: A minimum of 24 credits from Level 1 courses, and must include:

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics
BIOL1262	Living Organisms I
BIOL1263	Living Organisms II

LEVEL 2 6 credits as follows:

ZOOL2403	Maintenance Systems in Animals
ZOOL2404	Coordination and Control in Animals

LEVEL 3 9 credits as follows

BIOL3405	Pest Ecology & Management
ZOOL2402	Animal Physiology
ZOOL3403	Entomology

ZOOL3404	Parasitology
ZOOL3405	Vertebrate Biology
ZOOL3406	Immunology

MAJOR IN PLANT BIOLOGY
(39 Advanced Credits)

Programme Overview

Plant Sciences is the scientific study of plant life and development. The Plant Biology major examines selected aspects of plant sciences through practical and theoretical studies to foster the desire for continued exploratory investigations into biological solutions to real-world problems.

Programme Outline

LEVEL 1: A minimum of 24 Credits from Level 1, 18 of which must be FST courses and include:

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics
BIOL1262	Living Organisms I
BIOL1263	Living Organisms II

LEVEL 2 A minimum of 18 credits which must include:

BOTN2401	Plant Form and Systematics
BOTN2402	Physiology of Plants
BIOL2401	Research Skills and Practices in Biology
BIOL2402	Fundamentals of Biometry
BIOL2403	Principles of Ecology
BIOL2404	Molecular & Population Genetics

LEVEL 3 A minimum of 21 credits which must include:

BIOL3403	The Biology of Soil
BOTN3402	Plant Breeding
BOTN3404	Economic Botany
BOTN3405	Plant Ecophysiology
BOTN3406	Tropical Forest Ecology

And 6 credits from any of the following:

BOTN3401	Principles of Plant Biotechnology
BOTN3403	Fundamentals of Horticulture
BIOL3404	Virology
BIOL3405	Pest Ecology & Management

MINOR IN PLANT BIOLOGY
(15 Advanced Credits)

Programme Overview

Students will be exposed to the fundamental principles in the plant sciences through practical and theoretical studies of the interrelationships between plants and their environment and the anatomy, morphology and physiology of higher plants.

Programme Outline

LEVEL 1: A minimum of 24 Credits from Level 1, 18 of which must be FST courses and include:

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics
BIOL1262	Living Organisms I
BIOL1263	Living Organisms II

LEVEL 2 9 credits as follows:

BOTN2401	Plant Form and Systematics
BOTN2402	Physiology of Plants
BIOL2403	Principles of Ecology

Level 3 6 credits as follows:

BOTN3401	Principles of Plant Biotechnology
BOTN3402	Plant Breeding
BOTN3403	Fundamentals of Horticulture
BOTN3404	Economic Botany
BOTN3405	Plant Ecophysiology

MAJOR IN HORTICULTURE
(42 Advanced credits)

Programme Overview

The Horticulture Major is designed to provide students with a background in general horticultural science with special emphasis on the production of tropical and subtropical crops. The selection of courses in the programme provides the student with both the theoretical and the hands-on approach to learning the subject matter. In addition to the specialized courses offered, the programme is based on a solid core of traditional plant sciences courses.

Programme Outline

LEVEL 1: 12 credits as follows:

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics
BIOL1262	Living Organisms I

BIOL1263 Living Organisms II

A total of **42** Advanced credits from Level 2 which must include:

LEVEL 2: (18 Credits)
BIOL2401 Research skills and practices in Biology
BIOL2402 Fundamentals of Biometry
BIOL2403 Principles of Ecology
BIOL2404 Molecular and Population Genetics
***AGSL2401 Management of Soils**
BOTN2401 Plant Form and Systematics
BOTN2402 Physiology of Plants

LEVEL 3: (21 Credits) chosen from the list below (AG** courses are compulsory).
***AGCP3407 Post harvest Technology**
***AGCP3405 Landscape and Turf Grass Production**
***AGCP3406 Fruit Crop Production**
BOTN3403 Fundamentals of Horticulture
BOTN3402 Plant Breeding
BIOL3405 Pest Ecology and Management
***AGBU3012 Research Project (4 cr.)**
***AGBU3008 Agriculture Internship (4 cr.)**

***Courses in bold are unique to this major and compulsory**

MAJOR IN MARINE BIOLOGY
(39 Advanced Credits)

Programme Overview
The major in Marine Biology is designed to give students hands-on exposure to the study of the marine environment and its organisms. It enables students to gain detailed knowledge of the marine ecosystem so as to provide understanding of the concepts, strategies and practices available to scientifically investigate, analyse and manage marine species and communities.

Programme Outline
LEVEL 1: A minimum of 24 credits from Level 1, 18 of which must be FST courses and must include:
BIOL1017 Cell Biology
BIOL1018 Molecular Biology and Genetics
BIOL1262 Living Organisms I
BIOL1263 Living Organisms II

LEVEL 2 A minimum of 21 credits which must include

BIOL2401	Research skills & Practices in Biology
BIOL2402	Fundamentals of Biometry
BIOL2403	Principles of Ecology
BOTN2401	Plant Form & Systematics
BIOL2406	Eukaryotic Microorganisms
ZOOL2403	Maintenance Systems in Animals
ZOOL2404	Coordination and Control in Animals

LEVEL 3 A minimum of 18 credits which must include:

BIOL3407	Oceanography
BIOL3408	Coastal Ecosystems
BIOL3409	Caribbean Coral Reefs
ZOOL3408	Sustainable Use of Marine Fishable Resources
ZOOL3409	Aquaculture

And 3 credits from any of the following:

ZOOL3405	Vertebrate Biology
BIOL3410	Water Pollution Biology

The following companion courses are strongly recommended:

BIOL2408	Diving for Scientists
BIOL3018	Project
BIOL3412	Internship

MINOR IN COASTAL ECOSYSTEMS
(18 Advanced Credits)

Programme overview
A minor in Coastal Ecosystems serves as an introduction to the essentials of the coastal component of the marine environment which includes coral reefs, mangroves and seagrass beds. These are all habitats of prime importance in Jamaica and the Caribbean and have links with such diverse areas as Fisheries and Tourism.

Programme outline
LEVEL 1: A minimum of 24 credits from Level 1, 18 of which must be FST courses and must include:

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics
BIOL1262	Living Organisms I
BIOL1263	Living Organisms II

Level 2 9 credits as follows

BIOL2403	Principles of Ecology
BIOL2406	Eukaryotic Microorganisms
BOTN2402	Physiology of Plants

Level 3 9 credits as follows

BOTN3405	Plant Ecophysiology
BIOL3408	Coastal Ecosystems
BIOL3409	Caribbean Coral Reefs

MAJOR IN TERRESTRIAL AND FRESHWATER ECOLOGY
(39 Advanced Credits)

Programme Overview

The major in Terrestrial and Freshwater Ecology is designed to give students hands-on exposure to the study of terrestrial environments as well as lotic and lentic fresh water systems and associated organisms. It enables students to gain detailed knowledge of terrestrial animal communities so as to provide understanding of the concepts, strategies and practices available to scientifically investigate, analyse and manage terrestrial and freshwater species and communities.

Programme Outline

A **Major in Terrestrial and Freshwater Ecology** requires:

LEVEL 1: A minimum of 24 credits from Level 1, 18 of which must be FST courses and must include:

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics
BIOL1262	Living Organisms I
BIOL1263	Living Organisms II

LEVEL 2: A minimum of 21 credits which must include

BIOL2401	Research Skills & Practices in Biology
BIOL2402	Fundamentals of Biometry
BIOL2403	Principles of Ecology
BIOL2407	Biological Evolution
BOTN2401	Physiology of Plants
ZOOL2403	Maintenance Systems in Animals
ZOOL2404	Coordination & Control in Animals

LEVEL 3: A minimum of 18 credits which must include

BIOL3400	Issues in Conservation Biology
BIOL3406	Freshwater Biology
BIOL3410	Water Pollution Biology

BOTN3406	Tropical Forest Ecology
ZOOL3403	Entomology

And 3 credits from any of the following:

BIOL3403	The Biology of Soil
BIOL3405	Pest Ecology & Management
BOTN3405	Plant Ecophysiology

MINOR IN TERRESTRIAL AND FRESHWATER ECOLOGY
(15 Advanced Credits)

Programme Overview

The minor in Terrestrial and Freshwater Ecology is designed to provide an introduction to the biological aspects of conservation science; community ecology, population biology, biogeography, conservation genetics, and assessment of threatened or endangered species and habitats. The redesigned minor expands the coverage of conservation biology previously only focused on terrestrial ecosystems and will introduce students to an important area of biology and its applications, much neglected in the Jamaican and Caribbean context.

Programme Outline

LEVEL 1: A minimum of 24 credits from Level 1, 18 of which must be FST courses and include:

BIOL1017	Cell Biology
BIOL1018	Molecular Biology and Genetics
BIOL1262	Living Organisms I
BIOL1263	Living Organisms II

LEVEL 2: 6 credits as follows

BIOL2403	Principles of Ecology
BIOL2407	Biological Evolution

LEVEL 3: 9 credits as follows

BIOL3400	Issues in Conservation Biology
BIOL3406	Freshwater Biology
BOTN3406	Tropical Forest Ecology

COURSE DESCRIPTION

BIOL0011 **PRELIMINARY BIOLOGY I**

(6 P-Credits) Semester 1 Level 0

Pre-requisite**:** CSEC Biology or equivalent

Course Content**:** This course covers the following topics:

Biological Techniques

- Biological Chemistry: Chemicals of Life;
- Enzymes; Cells and Tissues; Cell Division; Genetics;
- Evolution; Mechanisms of Speciation;
- Variety of life: Bacteria, Protists, Fungi, Plants and Animals;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory paper 30%
- One 2-hours comprehensive paper 30%
- Course Work: 40%
  - One In-course theory test 6%
  - Two In-course practical tests 24%
  - Laboratory reports 10%

BIOL0012 **PRELIMINARY BIOLOGY II**

(6 P-Credits) Semester 2 Level 0

Pre-requisite**:** CSEC Biology or equivalent

Course Content: This course covers the following topics:

Organisms and the environment

- Levels of Ecological Organisation;
- Energy Flow;
- Biogeochemical Cycles;

Systems in plants and animals

- Plant Structure;
- Transpiration, Translocation, Photosynthesis;
- Animal structure;
- Respiration, Transport, Nutrition;

- Coordination and Control, Excretion and Osmoregulation;
- Movement and Support;
- Reproduction, Growth and Development;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory paper 30%
- One 2-hours comprehensive paper 30%
- Course Work: 40%
  - One In-course theory test 6%
  - Two In-course practical tests 24%
  - Laboratory reports 10%

BIOL1017 **CELL BIOLOGY**
(3 Credits) Semester 1 Level 1

Pre-requisite: A pass in one of the following: Preliminary Biology I and II (BL05A/BIOL0011 and BL05B/ BIOL0012) or CAPE ('A' level) Biology or equivalent

Course Content: This course covers the following topics:

Identify and characterize various types of cells and their levels of biological organization

- Mount living organisms for proper examination under the various types of light microscopes;
- Explain how the cellular components are used in the transfer and utilization of energy and information in cells;
- Interpret experimental data derived from hypothetical investigations into cell function;
- Analyse the effectiveness of the mechanisms utilized by cells to maintain internal thermodynamic stability;
- Apply their knowledge of cell biology to selected examples of response(s) that take place within cells consequent upon defined environmental or physiological changes;
- Outline the processes by which cells gather raw materials from the environment, construct out of these a new cell in its own image, complete with a new copy of the hereditary information;
- Describe the basic functional events involved in cell reproduction and the factors that regulate this process;

Microscopical techniques to study living and fixed cells

- Structural organization of cells;
- Specialization in cells;
- Basic functional processes in cells and their regulation;
- Mitosis and Meiosis;

Practical Work

- Observation of living cells and permanent microscopical preparation;
- Making microscopical preparations;
- Interpretation of electron micrographs;

Evaluation:
(Students are required to pass both components):

- One 2-hours comprehensive paper 50%
- Course Work: 50%
    - Laboratory reports 20%
    - Tutorial attendance and assignments 10%
    - One 1-hour In-course test 20%

<u>BIOL1018</u> **<u>MOLECULAR BIOLOGY AND GENETICS</u>**
(3 Credits) Semester 1 Level 1

Pre-requisites: A pass in one of the following: Preliminary Biology I and II (BL05A/BIOL0011 and BL05B/ BIOL0012) or CAPE ('A' level) Biology or equivalent

Course Content: This course covers the following topics:

Molecular Biology

- The nature of genes;
- DNA replication;
- Transcription;
- Protein synthesis;
- Control of gene expression;
- PCR, cloning and DNA sequencing;

Genetics

- Mendelian Inheritance;
- Probability, binomial theorem and chi-square test;
- Quantitative traits;
- Linkage, crossing over and mapping;
- Sex linkage and sex determination;
- Gene frequencies in natural populations;

Practical Work

- DNA isolation, restriction digestion and agarose electrophoresis;
- Exercises on Mendelian crosses and gene frequencies;

Evaluation:
(Students are required to pass both components):

- One 2-hour comprehensive paper 50%
- Course Work: 50%
    - Laboratory reports 20%
    - Tutorial attendance & assignments 10%
    - One 1-hour In-course test 20%

BIOL1262 **LIVING ORGANISMS I**
(3 Credits) Semester 2 Level 1

Pre-requisites: A pass in: Preliminary Biology I and II (BIOL0011 and BIOL0012), OR CAPE Biology (Units 1 and 2), OR equivalent training

Couse Content: This course covers the following topics:

- Evolutionary Concepts;
- Archaebacteria & Eubacteria;
- Autotrophic protists;
- Phylogeny and classification of plants;
- Bryophytes;
- Seedless vascular plants;
- Seed plants – Gymnosperms;
- Seed plants – Angiosperms (form and function);
- Photosynthetic systems;
- Reproductive systems;
- Ecology;

Practical Work

- Structure of bacteria and protists
- Classification of plants;
- Studies of the structure of the main groups of plants;
- Demonstrations of adaptive radiation of main groups of plants;
- The virtual and actual herbarium;
- The dichotomous key;

Evaluation:
(Students are required to pass both components):

- Final Examination:
- One 2-hours Comprehensive paper 50%
- Course Work: 50%
    - Tutorials 10%
    - Laboratory reports (10 x 2% each) 20%
    - One In-course test 20%

<u>BIOL1263</u> **<u>LIVING ORGANISMS II</u>**

(3 Credits) Semester 2 Level 1

Pre-requisites: A pass in: Preliminary Biology I and II (BIOL0011 and BIOL0012); OR CAPE Biology (Units 1 and 2); OR equivalent training

Course Content: This course covers the following topics:

- Origin of animals;
- Evolution of diversity;
- Classification and phylogeny of animals;
- Ecological principles;
- Animal-like protists;
- Animal Architecture;
- Invertebrate animals;
- Vertebrate animals;
- Major groups of fungi;
- Classification of animals;
- Studies of the morphology of the main groups of animals and fungi;
- Dissection of selected animals to show internal anatomy and evolutionary development of the taxonomic group;
- Demonstrations of adaptive radiation of main groups of animals and fungi;

Evaluation:
(Students are required to pass both components):

- One 2-hours Comprehensive paper 50%
- Course Work: 50%
    - Tutorial 10%
    - Laboratory reports (10 x 2% each) 20%
    - One In-course test 20%

AGSL2401 **MANAGEMENT OF SOILS**

(3 Credits) Semester 1 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

- Soil basics- texture and structure ;
- Methods of land clearing and their effects on soil structure;
- Soil tillage and the management of soil structure for plant growth;
- Management of soil structure to improve water intake, transmission and storage;
- Soil and crop water relations, water management for salinity control; soil erosion and the management of hillsides;
- Management of dry and wet lands;
- Management of forest soils; management of specific problem soils:
- Management for agriculture, soil management and its effects on microbes, microbial activity and soil fertility;
- Soil fertility management; soil quality, carbon sequestration;
- Soil management practices case studies.

Evaluation:
(Students are required to pass both components):

- One 2 hours theory examination 60%
- Course Work: 40%
    - One 2-hours practical test 20%
    - Laboratory reports (4 at 5%) 20%

BIOL2401 **RESEARCH SKILLS AND PRACTICES IN BIOLOGY**

(3 Credits) Semester 1 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, **and** a minimum of 24 credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

- Transferable skills (time management, note taking, production of accurate illustrations of microscopic and macroscopic specimens, group dynamics and coordination of group activities);
- Information technology and library resources;
- Bioethics: Plagiarism, fabrication and falsification of data;
- Scientific Communication;
- Laboratory techniques and procedures;
- Field work- approaches and procedures
- Analytical skills;
- Collecting and identifying specimens;
- Manipulating and observing specimens;
- Basic analysis and presentation of data;
- Data handling, display and interpretation, and basic statistical analysis.

Evaluation:

- One 2-hour Final Examination Paper 50%
- Course Work: 50%
    - One 1hour MCQ Course Test 20%
    - Literature review 20%
    - Oral presentation based on Laboratory Reports (2 x 5% each) 10%

BIOL2402 **FUNDAMENTALS OF BIOMETRY**

(3 Credits) Semester 1 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, **and** a minimum of 24 Credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

- Data in Biology: types of variables; accuracy and significant figures; data management;
- Populations and Samples: statistical populations; the need for samples; sampling procedures;
- Descriptive Statistics: frequency distributions; measures of central tendency; measures of dispersion;
- The Normal Distribution: probability density

functions; properties of the normal distribution; the distribution of sample means; confidence intervals;

- Statistical Hypothesis Testing: making decision about populations based on samples; null and alternative hypotheses; alpha and beta error;
- One-Sample Hypotheses: hypotheses concerning population parameters; testing goodness of fit;
- Testing the relationship between two variables: the nature of a statistical relationship; criteria used to select appropriate tests; overview of major tests;
- Applying tests for two variables: contingency tests; analysis of variance; regression and correlation; rank tests; multiple comparisons; assessing validity of statistical assumptions;
- Tests for more than two variables: separating the influences of multiple independent variables on a dependent variable; statistical interaction;

Evaluation:
(Students are required to pass both components):

- 2-hour Final Examination Paper 60%
- Course Work: 40%
    - One 2-hours practical test 20%
    - Laboratory Reports (4 x 5% each) 20%

BIOL2403 **PRINCIPLES OF ECOLOGY**
(3 Credits) Semester 2 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24
credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

- Ecology and its domain;
- Geographic range habitat and niche, abiotic and biotic environment;
- Ecological role of abiotic factors (climatic and edaphic) on plant and animal populations Population performance along physical gradients;
- Population structure and demography; population change over time, growth models, dispersal, life tables and resource allocation

patterns;

- Species interactions: competition, predation, herbivory, commensalism, ammensalism, protocooperation and mutualism;
- Communities; community classification, concepts and attributes;
- Island Communities;
- Primary and secondary ecological succession;
- Nutrient cycling and energy flow;
- Primary and secondary production, trophic levels and ecological efficiency;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination paper 50%
- Course Work: 50%
    - One 2-hour practical test 20%
    - Laboratory and field reports 20%
    - One 1-hour MCQ test 10%

BIOL2404 **MOLECULAR & POPULATION GENETICS**
(3 Credits) Semester 2 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

- The molecular and physical basis of inheritance;
- The genomes of viruses, bacteria, and higher organisms;
- The structure, expression, regulation, recombination, mapping, modification and manipulation (cloning) of genes;
- Embryonic development;
- The measurement and transmission of genetic variation (genes/alleles, genotypes) through time and space leading to speciation in plant and animal populations;

Evaluation:
(Students are required to pass all components)

- One 2-hour theory examination paper 60%
- Course Work: 40%
    - One 2-hour practical test 20%
    - Laboratory reports (4 x 5% each) 20%

****<u>BIOL2405</u>** **<u>THE BIOLOGY OF MICROORGANISMS</u> ****
(Not available in 2015/2016)
(3 Credits) Semester 2 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24 credits from Level 1, 18 of which must be FST courses

Course Description: The course introduces students to the evolution, ecology and metabolism of microorganisms. In particular, emphasis will be placed on the ecological roles of eukaryotic microorganisms. Attention will be given to the various groups of microorganisms in relation to their interactions with the environment, including both beneficial and harmful aspects of these interactions.

Courses Content: This course covers the following topics:

- General characteristics of each type of microbe (viruses, viroids, prions, archaea, bacteria, protozoa, algae, and fungi);
- Classification of microbes;
- Cell structure, metabolic diversity, growth and reproduction;
- Microbial genetics;
- Microbial interactions with humans and other animals;
- Microbial ecology (ecosystems, symbiosis, microorganisms in nature, agricultural uses);
- Industrial microbiology (microbial products, biotransformation, waste water treatments, biodegradation, bioremediation)

Evaluation:
(Students are required to pass all components)

- One 2-hour final examination paper 50%
- Course Work: 50%
    - Two 1-hour Course Tests 20%

- Laboratory Reports (3 x 10% each) 30%

BIOL2406 **EUKARYOTIC MICROBIOLOGY**
(3 Credits) Semester 1 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:
A study of the structure and function, taxonomy, reproduction, physiology and ecological applications of the protists and fungi inclusive of:

- The evolution of the eukaryotic condition;
- The biological diversity and phylogeny of the protists and fungi;
- The nutrition and adaptations within the protists and fungi;
- A systematic study of the major taxonomic groups:
  - Diplomonads;
  - Parabasilids;
  - Euglenoids;
  - Alveolates;
  - Stramenopiles;
  - The Algae;
  - Cyanophyta;
  - Glaucophyta;
  - Rhodophyta;
  - Chlorophyta;
  - Streptophyte algae;
- The Fungi & fungal-like microorganisms;
- Reproduction in the protists and fungi;
- Ecology and economic importance of the protists and fungi;
- Management of the protists and fungi;

Laboratory exercises include two group projects directed at the investigation of the morphology, physiology and ecology of selected protists and fungi involving the techniques of: light microscopy, isolation, inoculation techniques, aseptic technique and sterilization, making media, culture of microorganisms, and staining. Students are required to actively participate in interactive tutorial sessions in which they are required to apply their understanding of the material *presented in lectures and demonstrate their understanding of the laboratory exercises.*

Evaluation:
(Students are required to pass all components)

- One 2-hour final examination paper 50%
- Course Work: 50%
    - One 2-hour practical test 20%
    - Laboratory reports 20%
    - Project report 10%

BIOL2407 **BIOLOGICAL EVOLUTION**
(3 Credits) Semester 1 Level 2

Pre-requisites BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

- A historical perspective to evolution and variation;
- Hardy-Weinberg equilibrium, mutation, selection, migration, and genetic drift; non-random mating and inbreeding;
- Evolution below the species level, adaptation;
- Sex ratio, sexual selection, kin selection;
- Speciation, systematics, and the evolution of hominids;

Evaluation:
(Students are required to pass both components):

- One 2-hours final examination paper 50%
- Course Work: 50%
    - Two1hour MCQ papers (2 X 20%) 40%
    - Laboratory report (1 X 10%) 10%

BOTN2401 **PLANT FORM AND SYSTEMATICS**
(3 Credits) Semester 1 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24 credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

- Plant body organization; Plant form and the environment Structures involved in:
- Accessing raw materials from the environment;
- Structural support of the plant body;
- Anatomical specializations and structural adaptations of plants;
- Excretory processes;
- Plant reproduction;
- Plant habit types and their anatomical features;
- The evolution of plants;
- Plant life cycles;
- Plant systematics;
- Sources of taxonomic data;
- Contemporary taxonomic system and nomenclature of plants;
- Analysis and interpretation of taxonomic data;
- Herbaria and plant taxonomic research;
- Plant identification
- Sporiferous non-vascular Plants:
    - Anthocerotophyta;
    - Hepaticophyta;
    - Bryophyta;

Sporiferous vascular plants:

- Pteridophyta;
- Sphenophyta;

Seed-bearing plants:

- The seed habit;
- Gymnosperms;
- Angiosperms;

Evaluation:
(Students are required to pass both components):

- One 2 hour theory examination paper 50%
- Course Work: 50%
    - One 2-hour practical test 20%
    - Laboratory reports (4 x 5% each) 20%
    - One 1-hour MCQ test 10%

BOTN2402 **PHYSIOLOGY OF PLANTS**

(3 Credits) Semester 2 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24 credits from Level 1, 18 of which must be FST courses

Course Content: This course covers the following topics:

How plants function at the level of cells, tissues, organs and the whole plant.

- Carbon fixation and the different photosynthetic pathways;
- Growth, development and differentiation of plant tissues and organs;
- Roles of Plant Growth Regulators in the physiology and biochemistry of cells and whole plants;
- Soil-plant relations, where and how water and nutrients are transported in plants;
- Source-ink relations and translocation of photosynthates;
- Introduction to secondary metabolites and their roles in the physiology and the biochemistry of plants;

Evaluation:

(Students are required to pass both components):

- One 2-hour theory examination 50%
- Course Work: 50%
  - One 2-hour practical test 20%
  - Practical reports (5 x 4%) 20%
  - One 1-hour In-course quiz 10%

ZOOL2401 **ANIMAL FORM**

(Not available from 2013/14)

(3 Credits) Semester 2 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24 credits from Level 1, 18 of which must be FST courses

Course Description: The course serves as an introduction to the gross structure and cellular organization of animals with emphasis on systems in animals. In all topics, examples are drawn from both vertebrate and invertebrate phyla.

Course Content: This course covers the following topics:

- Structures and systems associated with feeding in animals;
- Structures and systems associated with excretion and osmoregulation;
- Structures and systems involved in gaseous exchange in animals;
- Nervous systems and muscles;
- Endocrine systems;
- Animal reproductive structures and systems;

Evaluation:
(Students are required to pass both components):

- One 2-hour theory examination 50%
- Course Work: 50%
  - One 2-hour practical test 20%
  - Laboratory reports (5 x 4%) 20%

ZOOL2402 **ANIMAL PHYSIOLOGY**
(Available from 2014/15)
(3 Credits) Semester 2 Level 2

Pre-requisites: BIOL1017, BIOL1018, BIOL1262, BIOL1263 or equivalent, and a minimum of 24 Credits from Level 1, 18 of which must be FST courses

Course Description: The course serves as an introduction to the functioning of selected physiological systems in a range of animals. In all topics covered, examples are drawn from both vertebrate and invertebrate phyla.

Course Content: This course covers the following topics:

- Digestive physiology;
- Exchange and transport of respiratory gases;
- Excretion of nitrogenous waste and salt and water balance;
- Generation of nervous impulses and neuromuscular control;
- Hormonal control and homeostasis;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 50%

- Course Work: 50%
    - One 2-hours practical test 20%
    - Laboratory reports (5 x 4% each) 20%
    - One 1-hour MCQ Test 10%

ZOOL2403 **MAINTENANCE SYSTEMS IN ANIMALS**
(3 Credits) Semester 2 Level 2

Pre-requisites: BIOL1017: Cells Biology; BIOL1018: Molecular Biology & Genetics BIOL1262: Living Organisms I; BIOL1263: Living organisms II

Course Content: This course covers the following topics:

- **Feeding and digestion**: Structures a used for mastication, digestion, absorption and storage of food
- **Gut Systems**: types of gut systems, overview gut systems of vertebrates and invertebrates.
- Gaseous exchange :Important physical considerations: oxygen availability in different environments, diffusion of gases in air and water, impact of shape and size.Breathing in water and air, adaptations for diving:
- **Circulatory Systems**: Comparison of gastrovascular and blood vascular systems; open and closed systems , Components of circulatory systems of selected invertebrates and vertebrates, Evolution of vertebrate circulatory system, microcirculation in vertebrates
- **Excretion and Osmoregulation**: Chemicals involved in excretion and osmoregulation, Contractive vacuoles, nephredia, malpighian tubules and nephrons, Secondary structures: salt glands, rectal glands, urate cells.
- **Reproduction**: Comparison of asexual and sexual reproduction. Alternation of generations.Sexual and asexual reproduction various animal groups
- **Colonial life**: case studies from Prolifera and Cnidaria

Evaluation:

- The course assessment will be as follows:
- One 2-hour final written examination 50%

- Coursework: 50%
- One 2-hour practical test 20%
- Laboratory reports (5 x 4% each) 20%
- One 1-hour MCQ Test 10%

ZOOL2404	**COORDINATION AND CONTROL IN ANIMALS** (3 Credits) Semester 2 Level 2
Pre-requisites**:**	BIOL1017: Cells Biology, BIOL1018: Molecular Biology & Genetics; BIOL1262: Living Organisms I, BIOL1263: Living organisms II

Course content: This course covers the following topics:

- **Embryonic Development and Structure of the Vertebrate and Invertebrate Nervous System:** Neurulation in the vertebrate, Regional specialization in the vertebrate brain, Meninges and tracts, Evolutionary trends in vertebrate brain development.
- **Reflex Action and Autonomic Function:** Structural basis of visceral and somatic reflexes, Comparative anatomy of the autonomic nervous system in vertebrates, Development and evolution of the eye in animals considering mollusc and vertebrate eyes and the compound eyes of Arthropoda, The acoustic-lateralis system, Structure and functioning of hair cells in the teleost lateral line system and in the inner ear, Evolutionary development of the mammalian middle ear bones.
- **The Structure of Selected Endocrine Glands and their Function:** Origins and embryonic development of the vertebrate hypophysis and adrenal gland, A survey of the endocrine system of insects, crustaceans and cephalopods.
- **Muscle Development and Function:** Embryological origins of the different muscle types their location and functions, Detail of the sliding filament theory of muscle contraction, The derivation of jaw muscles and facial muscles from the branchiometric musclature
- **The Integument:** Formation of the integument in insects and vertebrates, Epidermal and dermal derivatives and their functions.

Evaluation:
The course assessment will be as follows:

- One 2-hour final written examination 50%
- Coursework: 50%
- One 2-hour practical test 20%
- 9 Laboratory reports (equally weighted) 20%
- One 1-hour MCQ Test 10%

SUMMER SCHOOL ONLY:

BIOL2408 **DIVING FOR SCIENTISTS**
(3 Credits) Semester 3/4 Level 2

Pre-requisites (Lecturer's approval required)
(Students must have 24 first year credits in the FST, a certificate of "Fitness to Dive" from the University Health Centre and be able to pass a test of swimming competence.)

Course Content: This course covers the following topics:

- Principles of diving including the properties of water, pressure and buoyancy, gas laws, and air consumption;
- Physiology of diving including the effect of pressure on the human body, adverse effects of gases, barotraumas, the role of nitrogen in decompression illness (DCI), signs and symptoms of DCI;
- Safe diving practices including the use of decompression tables, diver rescue techniques and emergency ascents;
- Diving Equipment
- Diving as a tool for scientific research including an introduction to the fauna and flora of coral reefs;
- Underwater sampling and survey methods data collation and analysis;

Evaluation:
(Students are required to pass both components):

- Final Theory Examination (2 hours.) 50%
- Course Work: 50%
  - 5 Open water skills tests 30%
  - One 1-hour MCQ paper 10%
  - Oral presentation of research project 10%

AGBU3008 **AGRICULTURE INTERNSHIP**
(4 Credits) Summer Level 3

Pre-requisites: Lecturer's approval required

Co-requisite: AGBU3012

Course Content: This course covers the following topics:

- The basics of scientific writing, experimental
- design, project reporting and presentation.
- Aims and means of assessing feasibility of projects.
- Techniques in data collection, collation and analysis.
- Investigation and written report on an approved topic.

Evaluation:

- Project report 50%
- Oral Examination 50%

AGBU3012 (AM312) **RESEARCH PROJECT**
(4 Credits) Semester 1 & 2 Level 3

Pre-requisites: Lecturer's approval required

Course Content: This course covers the following topics:

- The basics of scientific writing, experimental design, project reporting and presentation;
- Aims and means of assessing feasibility of projects;
- Techniques in data collection, collation and analysis;
- Investigation and written report on an approved topic;

Evaluation:

- Project Report 80%
- Oral Presentation 20%

NOTE: Students will be examined at the end of the Semester in which they are registered.

AGCP3405 **LANDSCAPE AND TURFGRASS PRODUCTION**

**** Not Available in 2015/2016**

(3 Credits) emester 1 Level 3

Pre-requisite: BOTN2402

Course Description: Landscape and turfgrass production includes standards to prepare students for creating aesthetic and functional environments for homes, recreational and sporting facilities and businesses. This course includes site analysis and preparation, landscape drawing, plant selection, and installation. Maintenance of healthy attractive landscapes and turf areas will be emphasized. This will tool graduates for work in the private and public sector in the design and development of green spaces as well as their maintenance.

Course Content: This course covers the following topics:

- Introduction to Landscape and Turfgrass production;
- Landscape and Turfgrass Identification and uses;
- Turfgrass ecology and biology
- Landscape and turf establishment and renovation;
- Turf pest management (weeds, insects, diseases);
- Evaluating Opportunities in the Landscaping and Turfgrass Industries;
- Licensing laws and regulations pertaining to landscape contracting and maintenance;
- Environmental issues: water usage and pollution issues;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory paper 50%
- Course work: 50%
  - Practical (field) test (2 hours) 20%
  - Field exercise/field trip report 15%
  - Research and oral presentation 15%

AGCP3406 **FRUIT CROP PRODUCTION**
(3 Credits) Semester 2 Level 3

Pre-requisites: BOTN2401 and BOTN2402

Course Content: This course covers the following topics:

- classification of tropical fruit crops;
- Introduction to the status of fruit crop industry with specific reference to tropical/sub-tropical crops;
- The role of fruits in human nutrition
- The scientific principles of fruit crop growth and yield development;
- Production principles and technologies used in commercial fruit crop enterprises;
- Evaluation of the commercial potential of minor fruits;
- Current issues and research needs of tropical fruit crops in Jamaica;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 50%
- Course Work: 50%
    - Practical test (2 hours) 20%
    - Laboratory/field trip report 15%
    - Research and oral presentation 15%

AGCP3407 **POSTHARVEST TECHNOLOGIES**
(3 Credits) Semester 2 Level 3

Pre-requisite: BOTN2402

Course Content: This course covers the following topics:

- Ripening and Senescence of Fruits
  Maturation, Ripening, Senescence;
- Determinants of Readiness for Harvest
  Maturation index, ripening index;
- Harvesting Practices;
  Manual harvesting, Mechanical harvesting; Best Agricultural Practices and harvesting;
- Preparation for Storage and Transport
  Transportation, Handling, Packaging
- Storage Technologies Refrigeration, MA/CA packaging, Irradiation, Chemicals Other

physical technologies (IR, UVc, hot water, etc.);
- Post-harvest Changes and Loss of Value;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory paper 50%
- Course work: 50%
  - Consisting of one 2-hours practical test 20%
  - Laboratory and field trip report 15%
  - Research and oral presentation 15%

AGSL3001 **IRRIGATION AND DRAINAGE TECHNOLOGY**
(3 Credits) Semester 1 Level 3

Prerequisites: AGCP 2001

Course content This course covers the following topics:

- Soil water potential and measurements;
- Saturated /unsaturated water movement;
- Water movement to roots; evaporation, evapotranspiration and consumptive use.
- Sources of water; methods of water application;
- Design, installation, operation and evaluation of irrigation systems;
- Pumps and pumping for irrigation and drainage;
- Drainage principles; types of drains; planning, design and installation of drainages systems;
- Legal and administrative aspects of irrigation and drainage.

Evaluation:

- Coursework 25%
- Final examination 75%

<u>BIOL3018 (BL39C)</u> **<u>PROJECT **No longer available</u>**

(4 Credits) Semester 1 or 2 Level 3

Pre-requisite: BIOL2402 or BIOL2015 (BL20P)

This course is available to students at the discretion of the Department.

Course Content: This course covers the following topics:

- The basics of scientific writing, experimental design, project reporting and presentation.
- Aims and means of assessing feasibility of projects.
- Techniques in data collection, collation and analysis.
- Investigation and written report on an approved topic.

Evaluation:

- Project Report 75%
- Oral Presentation 25%

<u>BIOL3400</u> **<u>ISSUES IN CONSERVATION BIOLOGY</u>**

(3 Credits) Semester 2 Level 3

Pre-requisites: BIOL2403 and BIOL2407

Course Content: This course covers the following topics:

- Biological diversity and its values
- Threats to biological diversity: habitat destruction, exotic species, pollution, global climate change, and over-exploitation
- Conservation genetics and the population biology of threatened species
- Managing threatened species: *in-situ* and *ex-situ* interventions
- Establishing and managing protected areas
- Social framework for the conservation of biodiversity

Evaluation:
(Students are required to pass both components):

- One 2-hours theory paper 50%
- Course Work 50%

****BIOL3401** **ENVIRONMENTAL MICROBIOLOGY**
(Not available in 2015/2016)**
(3 Credits) Semester Level 3

Pre-requisite: BIOL2406

Course Content: This course covers the following topics:

- Cell Biology and Genetics: Overview of the chemical composition of microbial cells, cell structure, genetic elements, mutation and genetic exchange, taxonomy and phylogeny;
- Biosynthesis: Metabolism, anabolism, key enzymes, biosynthesis, nutrient assimilation, fuelling reactions, energetics;
- Metabolic Diversity: Aerobic respiration, diversity of aerobic metabolism, fermentation, anaerobic respiration, anaerobic food chains, autotrophy, regulation of activity;
- Methods: Sampling, detection, identification, enumeration
- Populations, Communities, Ecosystems: Interactions within and between populations, interactions with plants and animals, structure and dynamic of communities, abiotic factors;
- Applied Environmental Microbiology: importance of microorganisms in bio-deterioration, solid and liquid waste (sewage) treatment, bioremediation, biodegradation, biological pest control and public health
- Laboratory-based exercises on the techniques necessary to grow and identify microorganisms, recognition and differentiation of microbial characteristics in culture, identification based on metabolic differences and nucleic acid based techniques;

Evaluation:

One 2-hour theory examination	50%
Course Work:	50%

- Laboratory Reports (3 x 5%) 15%
- Student presentations 15%
- Participation in tutorials

- (submission of PBL responses) 5%
- In-course Test (1h) 15%

BIOL3402 **BIOLOGY OF THE FUNGI**
(Not available in 2015/2016)

(3 Credits) Semester Level 3

Pre-requisites: BIOL2406

Course Content: This course covers the following topics:

- The structural and ultra-structural characteristics and the ecological significance of the major groups of fungi of importance in the West Indies.
- The influence of genetic, nutritional and environmental factors on fungal growth, differentiation, reproduction and dispersal and germination of spores.
- The practical exploitation by man of fungal interactions.
    - Fungi as sources of food.
    - Fungal metabolite production.
    - The roles of fungi in biotechnology
- Prevention and control of fungal growth responsible for the bio-deterioration of commercial products.
- Collection, culture and preservation of fungi.

Evaluation:
(Students are required to pass both components):

- Final Theory Examination (2 hours) 50%
- Course Work: 50%
    - Laboratory reports (5 x 4%) 20%
    - Oral presentation of a tutorial topic 10%
    - One 2 hour In-course test 20%

BIOL3403 **THE BIOLOGY OF SOIL**

(3 Credits) Semester 1 Level 3

Pre-requisites: BIOL2403

Course Content: This course covers the following topics:

- The soil environment: soil formation and soil abiotic components; soil organisms: prokaryotic and eukaryotic microorganisms, animals and plant parts;
- Biological processes occurring in soil;
- Environmental issues affecting life in the soil: acid rain, metal toxicity, salinity, radioactivity, pesticides, and the introduction of organisms;
- The impact of agricultural practices and climate change on soil ecology and biodiversity;

Evaluation:
(Students are required to pass both components):

- One 2-hours Theory examination 50%
- Course Work: 50%
  - One 1-hour MCQ Test 15%
  - One 1-hour short-answer test 15%
  - Laboratory and field reports (5 x 4%) 20%

<u>BIOL3404</u> **<u>VIROLOGY</u>**
(3 Credits) Semester 2 Level 3

Pre-requisites: BIOL2404 or BIOL2312

Course Content: This course covers the following topics:

- Fundamental concepts of virology; structure, replication cycles, transmission, epidemiology of human, animal, plant and microbial viruses; laboratory diagnostic techniques;
- Laboratory-based exercises on the detection and basic characterization of viruses to include virus purification, bio-indexing, electron microscopy, serology, polymerase chain reaction and transmission.

Evaluation:
(Students are required to pass both components):

- One 2-hours Theory examination 60%
- Course Work: 40%
  - Laboratory Report 15%
  - Participation in tutorials (PBL responses) 5%
  - In-course Test (1hour) 20%

BIOL3405 **PEST ECOLOGY AND MANAGEMENT**

(3 Credits) Semester 2 Level 3

Pre-requisites: BIOL2401 and BIOL2403

Course Content: This course covers the following topics:

- Pest evolution;
- Population dynamics of pest species;
- Pest-host and pest-natural enemies interactions;
- Insects and diseases;
- Assessing pest populations and related economic impact;
- The concept of pest management;
- Pest management strategies;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 45%
- Course Work: 55%
    - Laboratory reports (5 x 4%) 20%
    - Insect pest collection 20%
    - Oral presentations 15%
    - Oral presentation on pest survey 5%
    - Oral examination 10%

BIOL 3406 **FRESHWATER BIOLOGY**

(3 Credits) Semester 2 Level 3

Pre-requisite: BIOL2403

Course Content: This course covers the following topics:

- Lotic habitats; Physico-chemical characteristics; Concepts of subdivision of rivers and their applicability to tropical locations; The allochthonous food web; Resilience and refuge theory
  Lentic habitats; Stratification and lake classification Productivity; Bio-manipulation and the cascade effect; Lake benthos;

- Field based collection of material and Evaluation of physico-chemical data Laboratory based identification of freshwater organisms;

Evaluation:
(Students are required to pass both components):

- Final theory examination (2 hours) 50%
- Course Work: 50%
    - Laboratory report 20%
    - Practical Examination 20%
    - Tutorial participation 10%

BIOL3407 **OCEANOGRAPHY**
(3 Credits) Semester 1 Level 3

Pre-requisite: BIOL2403

Course Content: This course covers the following topics:

- Ocean basins- their origin and structure;
- Chemical and physical properties of ocean water;
- Circulation and mixing: currents, waves & tides;
- Marine sediments- their origin and deposition;
- Form and function of planktonic organisms;
- Distribution of planktonic organisms;
- Primary production and its measurement;
- Secondary production and its measurement;
- Food chains/food webs in the pelagic province;
- Ocean Nekton;
- Vertical migration and the deep sea pelagic area;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 50%
- Course Work: 50%
    - Laboratory reports (5 x 5% each) 25%
    - Oral presentation of tutorial topic 5%
    - End of course practical test (2 hours.) 20%

BIOL3408 **COASTAL ECOSYSTEMS**
(3 Credits) Semester 1 Level 3

Pre-requisite: BIOL2403

Course Content: This course covers the following topics:

An examination of the diversity, productivity and functions associated with:

- beaches and dunes;
- coral reefs;
- mangroves forests;
- seagrass beds;
- estuaries and wetlands;

An examination of the range and impact of pollution affecting coastal ecosystems especially:

- organic;
- hydrocarbons;
- pesticides;
- heavy metals;
- physical and thermal pollution;

Exercises in evaluation of:

- coastal surveys;
- environmental monitoring;
- water quality ranges and criteria;
- zoning, parks and protected areas as conservation options of coastal ecosystems;

Method of Delivery:

- Lectures: 18 contact hours; 18 credit hours
- Tutorials: 6 contact hours; 6 credit hours
- Practical Work : 30 contact hours; 15 credit hours

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 50%
- Course Work: 50%
    - Practical test 2-hours 20%
    - Laboratory and field reports (5 X 4%) 20%
    - Research topic/oral presentation 10%

BIOL3409 **CARIBBEAN CORAL REEFS**
(3 Credits) Level 3 Semester 2

Pre-requisite: BIOL2403

Course Content: This course covers the following topics:

- An introduction to the reef geography of the wider Caribbean and history of reef resource use in Caribbean;

- Coral Biology including taxonomy, anatomy and skeletal morphology, endosymbiosis with zooxanthellae, calcification and growth, nutrition, defensive behaviour, reproduction and recruitment;
- Environmental conditions required for coral reef formation, geological history of Caribbean reef formation and types of reefs; dynamics of reef structure formation and erosion;
- Reef community structure, zonation and dynamics;
- Major reef-associated organisms with attention to their ecological function; Uses including reef fisheries, tourism and recreation, biodiversity and marine products, and ecosystem services;
- Valuation including Total Economic Value, use values, option values and non-use values;
- The threats and future challenges to Caribbean coral reefs including natural disturbances and anthropogenic activities; Hurricanes, tsunamis, and earthquakes; Coral diseases and diseases of reef organisms; Overfishing, deterioration of water quality, physical destruction of reefs, climate change, invasive species;
- An introduction to monitoring methods and the ecosystem-based approach to reef management, including examples of mitigation actions appropriate to different geographic scales;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 50%
- Course Work: 50%
    - One in-water practical test 10%
    - Five Laboratory and field reports 30%
    - One tutorial research essay 10%

BIOL3410 **WATER POLLUTION BIOLOGY**
(3 Credits) Semester 2 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Content: This course covers the following topics:

- Sources and effects of water pollution;
- Biological monitoring of water quality;
- Toxicity of pollutants to aquatic organisms;
- Water pollution and public health;
- Water pollution control;
- Invasive species and their consequences to aquatic habitats;

Field and laboratory based exercises including examination of sources of pollution, conducting a bio-monitoring programme in Jamaican rivers, determining toxicity levels, determining coliform levels and BOD.

Evaluation:
(Students are required to pass both components):

- Final theory examination (2 hours) 50%
- Course Work: 50%
    - Laboratory report 20%
    - Practical Examination (2 hours) 20%
    - Tutorials 10%

BIOL3411 **RESEARCH PROJECT**
(6 Credits) Semester: Any two consecutive semesters Level 3

Pre-requisites: Approval from Head of Department

Course Content: This course covers the following topics:

- Aims and means of assessing feasibility of projects;
- Techniques in data collection, collation and analysis;
- Ethical research, experimental design, project reporting and presentation
- Scientific writing
- Investigation and written report on an approved topic;

- Multi-media-based oral presentations –remove;

Evaluation:
(Students are required to pass both components):

- Project written report 75%
- Oral Examination: 25%
    - Presentation 5%
    - Knowledge & understanding 10%
    - Response to questions 10%

BIOL3412 **INTERNSHIP**
(3 Credits) Semester 3 Level 3

Pre-requisites: BIOL2401-*Research Skills and Practices in Biology*; BIOL2402-*Fundamentals of Biometry*; Internships are available to students doing BSc degrees in Life Sciences but placement is based on the availability of appropriate host companies. HOD approval of course selection is therefore required.

Course Content: This course covers the following topics:

- On the job operations in a selected area of the Life Sciences disciplines;
- Daily log generation and production of written reports related to specially designed or general activities;
- Self-Evaluation of performance and operations in the work environment;
- Evaluation of the practices, efficiencies and suggest possible improvement of the operations for the main enterprise(s) at the host institution;

Note for Student:
The student is expected to spend 30 hours per week for approximately 6 weeks working in one of the pre-selected participating organisations.
The student is required to:

- *meet regularly with the Departmental Internship Coordinator to discuss the internship experience and any work-related or logistical issues*
- *maintain a daily log of hours worked and a brief description of the work performed*

- *submit a final report summarising and evaluating the internship experience; and*
- complete a résumé and interview at the Office of Placement and Career Services, UWI (Mona)

Evaluation:
Internship report (graded by the Department coordinator) which summarize the activities carried out during the internship and how it relates to the BSc programme being pursued, documentation of the main operations and structure of the host organization, evaluation of the efficiency of the enterprise, and the student's own evaluation of the experience.

- The daily log of activities should be included as an appendix at the end of the report. 50%
- Evaluation of performance 25%
- Oral presentation 25%

<u>BIOL3413</u> **<u>BIOLOGY PROJECT</u>**
(3 Credits) Semesters 1, 2, 3, 4 Level 3

Pre-requisites BIOL2402 and HOD approval

Course Content: This course covers the following topics:

- The basic elements of scientific method, experimental design, project reporting and presentation.
- Aims and means of assessing feasibility of projects.
- Techniques in conducting a scientific study: data collection, collation and critical analysis.
- Scientific report writing on an approved topic.
- Power point presentations
- Review of research ethics

Evaluation:

- Project report (at least 2000 words) 75%
- Oral Examination(includes power point presentation) 25%

BOTN3401 **PRINCIPLES OF PLANT BIOTECHNOLOGY**

(3 Credits) Semester 2 Level 3

Pre-requisite: BOTN2402 or BIOL2312

Course Content: This course covers the following topics:

- Fundamental concepts of plant biotechnology; plant tissue culture, transformation of plants or plant cells, stress, pathogen and herbicide tolerance, Improved nutritional content and functional foods, phytoremediation, forest biotechnology, plants as green factories: production of plastics, fats/oils, fibers, proteins and biofuels, GMO-regulations;
- Laboratory-based exercises on plant micropropagation, transformation and molecular markers;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory paper 60%
- Course Work: 40%
    - Laboratory Report (2 x 7.5%) 15%
    - Participation in tutorials (PBL responses 5%
    - In-course Test (1hour) 20%

BOTN3402 **PLANT BREEDING**

(3 Credits) Semester 1 Level 3

Pre-requisites: BIOL2404

Course Description: This course will expose students to the achievements of plant breeding efforts from several countries and crops; discover the genetic basis of crop plant phenotypes; explore the wild and domesticated ancestors of our modern field crops as well as fruit and vegetable crops; design improvement strategies for self-pollinating, cross-pollinating and asexually propagated crops; run, work in a successful crop breeding program; develop molecular tools that will directly assist in the crop breeding process; formulate conservation strategies of the world's crop biodiversity through gene/germplasm banks.

Course Content: This course will include the following topics:

- Plant domestication and crop evolution;
- Reproduction in crop plants;
- Inheritance of quantitative characters and plant breeding;
- Breeding self-pollinated crops;
- Breeding cross-pollinated and clonally propagated crops;
- Breeding hybrid varieties by manipulation of fertility regulating mechanisms;
- Breeding for biotic and abiotic stress factors;
- Polyploidy and plant breeding;
- Germplasm resources, gene banks and conservation;
- New variety testing, release, maintenance and seed production; and
- Molecular breeding;

Evaluation:
(Students are required to pass both components):

- One Theory Examination (2 hours) 60 %
- Course Work: 40 %
    - One Practical Examination (2 hours) 20 %
    - One Midterm Examination (1 Hour) 10 %
    - Laboratory Reports (5 x 2 %) 10 %

BOTN3403 **FUNDAMENTALS OF HORTICULTURE**
(3 Credits) Semester 1 Level 3

Pre-requisites: BOTN2401 and BOTN2402

Course Content: This course covers the following topics:

- Horticultural Plants (as distinct from routine agricultural plants): morphology, taxonomy, environmental physiology;
- Propagation of Horticultural Plants: Sexual propagation, Seed production and certification, methods of seeding, seed nursery, transplantation Asexual propagation: cuttings, grafting, budding, layering, specialised underground structures, micropropagation; Nursery Management;

- Controlled Environment Horticulture: Greenhouse design and construction, Internal environment control, Light, irrigation, temperature, humidity, substrate, pot and bed culture;
- Out-door Environment culture principles of landscaping, nursery production, bedding plants, ground cover/grasses, trees and shrubs;
- Growing Garden Crops: ornamentals, vegetables, herbs, fruit trees; Post-Harvest Handling and Marketing of Horticultural Produce; Computers in Horticulture;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 50%
- Course Work: 50%
    - One 2-hours practical test 20%
    - Laboratory (10%) and field trip report (5%) 15%
    - Research (10%) and oral presentation (5%) 15%

BOTN3404 **ECONOMIC BOTANY**
(3 Credits) Semester 2 Level 3

Pre-requisites: BOTN2401 and BOTN2402

Course Content: This course covers the following topics:

- Plant families of medicinal and economic importance;
- Origin of agriculture;
  Ethnobotany
    - Medicinal Plants:
        - Herbs and spices;
        - Phytochemicals;
        - Nutraceuticals;
        - Aromatherapy;
        - Conventional and Alternative Medical Systems;
        - Naturopathy;
        - Integrative medicine;
        - Eastern methods;

  Social uses of plants:

- Fumitories;
- Masticatories;
- Ethnic, cultural & religious influences on plant usage;
- Plant Products: flavours and fragrances, gums, resins, oils, fibres;
- Under-utilized tropical plant food
- Timber and non-timber forest products;
- Economic uses of algae, bryophytes and pteridophytes;
- Conservation of medicinal and economically important plant genetic resources;

Evaluation:
(Students are required to pass both components):

One 2-hour theory examination	40%
Course Work:	60%
• Laboratory reports (3 x 5%)	15%
• Field project	10%
• Oral presentation & tutorials	15%
• 2-hours In-course test (theory and practical)	20%

BOTN3405 **PLANT ECOPHYSIOLOGY**
(3 Credits) Semester 1 Level 3

Pre-requisites: BOTN2402 and BIOL2401

Course Content: This course covers the following topics:

- An examination of the physiological adaptations of tropical plants to their environments using the following as examples:
- Tropical Forests (the physiology of nutrient cycling and photosynthetic plastic response);
- Epiphytes and Lianas (the physiology of foliar absorption);
- Mangroves and salinas (the physiology of water uptake and salt extrusion);
- Aquatic habitats (respiration and photosynthesis underwater);

- Savannas, deserts and dunes (the physiology of C3, C4 CAM, CAM shifting and CAM idling);

Evaluation:
(Students are required to pass both components):

- One 2-hours Theory Examination 50%
- Course Work: 50%
  - 2-hours practical test 20%
  - Five Laboratory and field reports (5 x 4%) 20%
  - One research project (group) with an oral presentation 10%

BOTN3406 **TROPICAL FOREST ECOLOGY**
(3 Credits) Semester 1 Level 3

Pre-requisite: BIOL2403

Course Content: This course covers the following topics:

- Origins of tropical rain forests;
- Origins of tropical forest diversity;
- Characteristics of tropical rain forests;
- Tropical rainforest formations;
- Tropical dry forests;
- Reproductive ecology of tropical rain forest trees;
- Reproductive ecology of tropical dry and moist forest trees;
- Principles of tropical forest hydrology;
- Tropical forest nutrient cycles;
- The effects of deforestation and habitat fragmentation;
- Payments of ecosystem services and REDD (reducing emissions from deforestation and forest degradation);
- Global climate change and tropical forest ecosystems;

Evaluation:
(Students are required to pass both components):

- One 2-hours theory examination 60%
- Course Work: 40%

- Research topic 10%
- Fieldwork reports (3 x 10%) 30%

ZOOL3403 **ENTOMOLOGY**

(3 Credits) Semester 2 Level 3

Pre-requisite: BIOL 2401

Course Content: This course covers the following topics:

- Biology of the insects including external and internal morphology in relation to taxonomy and evolution, life histories, social organizations where applicable, place in biosphere;
- Diversity of the insects including: taxonomy, an order-by-order survey with emphasis on Caribbean fauna and economically important groups;
- Examples of harmful groups including pests and vectors;
- Examples of beneficial taxa, such as those important for pollination, natural control of populations, and ecotourism;
- Practical Component: Laboratory exercises to study basic morphological structures as well as modifications; Exercises in taxonomy including use of binomial keys; Practice of techniques in the collection and curation of insects; Field trips to practice and evaluate various techniques; opportunities to collect insects and study their adaptations to a wide variety of habitats;

Evaluation:
(Students are required to pass both components):

- Final Theory Examination (2-hour) 50%
- Course Work: 50%
    - Insect Collection 25%
    - Laboratory reports (3) 15%
    - Oral Examination 10%

ZOOL3404 **PARASITOLOGY**

(3 Credits) Semester 1 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Content: This course covers the following topics:

- Fundamental concepts of parasitology; morphology, lifecycle, transmission, pathology and control of selected protist, helminth and arthropod parasites of humans and domesticated animals; laboratory diagnostic techniques; parasite ecology and evolution; parasite immunology; epidemiology of soil-transmitted helminth (STH) infections in the Caribbean region ;
- Laboratory-based exercises to include recognition and diagnosis of a range of parasitic infections of humans and domesticated animals;

Evaluation:
(Students are required to pass both components):

- Final Theory Examination (2hour) 50%
- Course Work: 50%
  - Laboratory Reports (10 x 3%) 30%
  - Participation in tutorials 5%
  - Visual Media Examination (2hour) 15%

ZOOL 3405 **VERTEBRATE BIOLOGY**

(3 Credits) Semester 1 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Content: This course covers the following topics:

- Vertebrate relationships and basic structure;
- Diversity and radiation of fishes;
- Radiation of tetrapod;
- Avian specializations;
- Radiation and diversity of birds;
- The evolution and biogeography of mammals;
- Mammalian characteristics, specializations and diversity;
- Aquatic mammals. Primate evolution.

- Ecology and social behaviour of mammals and birds;
- Herbivory;
- Reproductive strategies and population dynamics of vertebrate populations;
- Commensal vertebrates and vertebrate pests
- Practical Component: Field and laboratory-based exercises including, ecomorphology of fishes, lizard behaviour, composition of bird communities in different habitats, mammalian feeding strategies;

Evaluation:
(Students are required to pass both components):

- Final theory examination (2hours) 60%
- Course Work: 40%
  - Group presentation 20%
  - Laboratory report (5x3marks) 15%
  - Tutorial participation 5%

ZOOL3406 **IMMUNOLOGY**
(3 Credits) Semester 2 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Content: This course covers the following topics:

- Basic Immunology
  Components of innate and acquired immunity; immunogens and antigens; antibody structure and function; antibody-antigen interactions; the complement system; ontogeny of immune cells; triggering the immune response; the major histocompatibility complex in immune responses; control mechanisms in the immune response;
- Immunity in Action
  Immunoassays, hypersensitivity reactions, disorders of the immune response, HIV infection, autoimmunity, transplantation immunology, tumor immunology;
- Laboratory Work

Hiistology of lymphoid organs of the mouse; viable counts of splenic lymphocytes; precipitation & agglutination reactions; diagnostic immunology; problem-based learning exercises, etc;

Evaluation**:**
(Students are required to pass both components):

- One 2-hour theory examination 50%
- Course Work: 50%
  - One 2-hours MCQ paper 20%
  - Laboratory reports (5 x 6% each) 30%

ZOOL3407 **HUMAN BIOLOGY**
(3 Credits) Semester 1 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Content: This course covers the following topics:

- Human identity;
- Human development;
- Human functional systems;
- Musculo-skeletal;
- Neuro-sensory;
- Metabolic;
- Respiration;
- Circulatory;
- Urinary;
- Reproductive;
- Immune;
- Abnormalities e.g. cancer, congenital, autoimmune;
- Human heredity and genetics; aging;
- Human evolution;
- Man and the environment;
- Normative ethics; environmental ethics;

Evaluation:
(Students are required to pass both components):

- One 2-hour theory examination 50%
- Project Written Report 50%

ZOOL3408 **SUSTAINABLE USE OF MARINE FISHABLE RESOURCES**

(3 Credits) Semester 2 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Content: This course covers the following topics:

- Fish biology: External form and functional design; Locomotion; swim bladders; red muscle; Growth and estimation of growth rates, ageing techniques; reproduction & larval life;
- Fisheries Evaluation: Fishing techniques; Fish population dynamics, stocks, populations, recruitment, mortality; Fish populations & exploitation, fishing effort, CPUE, yield, yield models, MSY, OEY; Introduction to fisheries modeling & Evaluation software;
- Caribbean fisheries: Jamaica reef fisheries; Pelagics; Guyana shelf fisheries; Lobster & conch fisheries;
- World fisheries: Case study- Peruvian anchoveta collapse, El Nino, ENSO phenomenon; Lionfish invasive in Atlantic & Jamaica; Large marine mammal exploitation;
- Fisheries management: Principles of fisheries management; Paradigm shifts in management;
- Practical Component: Laboratory demonstration of fishable species showing variability and difficulties of exploitation; Investigation of Fishable resources of Kingston Harbour demonstrating gear operation, gear selectivity, factors affecting resource distribution; Field trips to major fish landing site tours, fisher interviews, commercial catches and gears, stage 2 issues, marketing & economic factor; Visit to the Lionfish project at DBML, St. Ann, snorkeling on reef demonstrating invasive effects, management of invasives, lionfish behaviour and distribution studies; Caribbean Coastal Area Management Foundation (CCAMF), Salt River, Clarendon & fish sanctuary tour to demonstrate fisheries co-management issues, ecology of sanctuaries, reality of management of a major coastal zone.

Evaluation:
(Students are required to pass both components):

- Final Theory Examination (2 hours) 60%
- Course Work: 40%
    - In-course test (2 hours) 20%
    - Practical assignments (4x5%) 20%

ZOOL3409 **AQUACULTURE**

(3 Credits) Semester 1 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Content: This course covers the following topics:

- Water quality: Dissolved gases, alkalinity and hardness, Nitrogen cycles, Phosphorus cycle, Sulphur cycles, iron cycle and Redox potential;
- Hatchery management practices: Modern hatchery systems, fish seed production, hormonal treatment, fish propagation in hatcheries, fry handling and transportation;
- Pond construction: Site selection criteria, site surveying and pond design, water supply, pond management;
- Fish culture, Nutrition and Diseases: Fish culture, fish production principles, stocking rates, fertilization, food chemistry, feed composition, common diseases, prophyllaxis and treatment;
- Shrimp culture and Oyster culture: Marine shrimps and freshwater prawns, lobsters, oyster culture, harvesting technologies;
- Practicals Component: Water quality on a commercial fish farm, monitoring and evaluation 2. Hatchery on commercial fish farm, Longville Park, Clarendon, 3. Pond infrastructure and construction principles, surveying ponds, Twickenham Park Station, St. Catherine, 4. Tilapia fry production, food fish production on commercial fish farm, Barton Isle, St. Elizabeth, 5. Oyster culture technologies and harvesting methods, Bowden Bay, St. Thomas;

Evaluation:
(Students are required to pass both components):

- Final Theory Examination (2 hours) 50%
- Course Work: 50%
  - In-course test (2 hours) 20%
  - Practical reports (5 x 6%) 30%

ZOOL3410 **ADVANCED TOPICS IN ANIMAL SCIENCE**
(3 Credits) Semester 2 Level 3

Pre-requisites: ZOOL 2401or ZOOL2403 and ZOOL2402 or ZOOL2404

Course Description: This seminar course will provide students with advanced, transferrable, specialized or applied exposure to current topics in animal and human biology through a structured series of formal presentations by local and overseas experts in the industry. It aims to equip students with in-depth awareness of the relevance of a diverse array of topical issues to the Caribbean, and with such transferable skills prepare them for the industry, or advanced studies in the field of animal or human biology.

Course Content: This course covers the following topics:

- Loss of biodiversity and ecosystem balance;
- Ethical treatment of animals;
- Research ethics;
- Animal diseases;
- Rapid survey techniques;
- Horizontal gene transfer;
- Animal behaviour;
- Embryology;
- Climate change; diverse perspectives;
- Overpopulation;
- Zoological gardens;
- Professional zoology;
- Paleozoology;
- Permitting of investigations;
- Logical framework approach;
- Euthanasia;
- Evolution of HIV;
- Thinking critically;

Evaluation:
(Students are required to pass both components):

- Reflective Journal Record (10 x 5%) 50%
- In-depth written Analysis 50%

Department OF Mathematics

BSc.
Actuarial Science
Mathematics with Education Studies
Mathematics and Modelling processes

MAJORS
Mathematics
Statistical Science

MINOR
Mathematics

UNDEGRADUATE COURSES OFFERED BY THE DEPARTMENT OF MATHEMATICS

CODES	TITLES	CREDIT	SEMESTER OFFERED	PREREQUISITES
PRELIMINARY				
M08B/MATH0100	**Pre-Calculus**	**6**	**1**	**CXC Mathematics or equivalent**
M08C/MATH0110	**Calculus And Analytical Geometry**	**6**	**2**	**CXC Mathematics or equivalent**
LEVEL 1				
MATH1141	**Introductory Linear Algebra And Analytic Geometry**	**3**	**1**	**CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110 or equivalent**
MATH1142	**Calculus I**	**3**	**1**	**CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110 or equivalent**
MATH1151	**Calculus II**	**3**	**2**	**Calculus I, MATH1142**
MATH1152	**Introduction To Formal Mathematics**	**3**	**2**	**CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110 or equivalent**
MATH1180	**Engineering Mathematics I**	**3**	**1**	**CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110, or equivalent**
MATH1185	**Calculus For Scientists And Engineers**	**3**	**1**	**CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110 or equivalent.**

STAT1001	**Statistics For The Scientists**	**3**	**1 and 2**	**CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110 or equivalent.**
LEVEL 2				
MATH2401	**Elements Of Mathematical Analysis**	**3**	**1**	**MATH1141, MATH1142, MATH1151 and MATH1152 or M10A, M10B**
MATH2230	**Engineering Mathematics II**	**3**	**I**	**MATH1180**
MATH2403	**Multivariable Calculus**	**3**	**2**	**MATH1141, MATH1142 and MATH1151 or MATH1185 or M10A and M10B**
MATH2404	**Introduction To Probability Theory**	**3**	**1**	**MATH1141, MATH1142, MATH1151 & MATH1152 or M10A & M10B**
MATH2407	**Stochastic Modeling**	**3**	**2**	**MATH2404**
MATH2410	**A First Course In Linear Algebra**	**3**	**1**	**(MATH1141 & MATH1152) or (M10A & M10B)**
MATH2411	**Introduction To Abstract Algebra**	**3**	**2**	**(MATH1141 & MATH1152) or (M10A & M10B)**
MATH2420	**Ordinary Differential Equations**	**3**	**2**	**(MATH1141, MATH1142, MATH1151 & MATH1151) or (M10A & M10B)**
MATH2421	**Fourier Series And Integral Transforms**	**3**	**1**	**(MATH1141, MATH1142 & MATH1151) or (MATH1185) or (M10A & M10B)**
MATH2430	**Linear Optimization**	**3**	**2**	**(MATH1141 & MATH1152) or (M10A & M10B)**
MATH2431	**Non-Linear Optimization**	**3**	**1**	**(MATH1141 & MATH1142) or (M10A & M10B)**
MATH2701	**Financial Mathematics I**	**3**	**1**	**(MATH1141, MATH1142, MATH1151 & MATH1152) or (M10A & M10B)**
MATH2702	**Actuarial Mathematics I**	**3**	**2**	**MATH2701 and MATH2404**
STAT2001	**Inferential Statistics**	**3**	**2**	**STAT1001 or MATH2404**

STAT2002	**Discrete Statistics**	**3**	**2**	**STAT1001, MATH1142**
STAT2003	**Linear Models**	**3**	**2**	**STAT1001, STAT2001**
STAT2004	**Multivariate Methods**	**3**	**2**	**STAT1001, MATH1141, MATH2410**
		LEVEL 3		
MATH3155	**Complex Variables**	**3**	**1**	**MATH2401**
MATH3401	**Introduction To The Theory Of Integration**	**3**	**1**	**MATH2401**
MATH3402	**A Course On Metric Spaces And Topology**	**3**	**2**	**MATH2401**
MATH3403	**Some Topics In Functional Analysis**	**3**	**2**	**MATH2401**
MATH3404	**Introduction To Differential Geometry With Computer Software**	**3**	**2**	**MATH2410, MATH2403**
MATH3405	**Number Theory**	**3**	**1**	**MATH2401, MATH2411**
MATH3411	**Advanced Abstract Algebra**	**3**	**2**	**MATH2411**
MATH3412	**Advanced Linear Algebra**	**3**	**1**	**MATH2410**
MATH3414	**Selected Topics In Operations Research**	**3**	**1**	**MATH2404**
MATH3421	**Partial Differential Equations**	**3**	**1**	**MATH2420**
MATH3422	**Mathematical Modelling**	**3**	**1**	**MATH2401, MATH2410, MATH2420**
MATH3423	**Research Project In Mathematics**	**3**	**2**	**MATH2401, MATH2420, Courses prescribed by the supervisor with the nature of the project**
MATH3424	**Numerical Methods**	**3**	**2**	**MATH2401**

MATH3425	**Techniques For Solving Advanced Mathematics Problems**	**3**	**1**	**MATH2401, MATH2410**
MATH3801	**Financial Mathematics II**	**3**	**1**	**MATH2701, MGMT2023, MGMT3048, MATH2404**
MATH3802	**Evaluation Actuarial Models**	**3**	**2**	**MATH2702, MATH2404, STAT2001**
MATH3803	**Models For Financial Economics**	**3**	**2**	**MATH3801**
MATH3804	**Actuarial Mathematics II**	**3**	**1**	**MATH2701, MATH2702**
MATH3805	**Mathematics of Pension Funds**	**3**	**2**	**MATH2701, MATH2702, MATH3804**
MATH3806	**Topics In General Insurance**	**3**	**2**	**MATH2701, MATH2404**
STAT3001	**Regression Analysis**	**3**	**1**	**STAT2001 and MATH2410 (background)**
STAT3002	**Time Series**	**3**	**2**	**MATH2404, STAT2001**
STAT3003	**Design & Analysis of Experiments**	**3**	**2**	**STAT2001**

MATHEMMATICS MAJORS AND MINORS

The Department of Mathematics currently offers B.Sc. in: Actuarial Science, Mathematics (Major and Minor), Mathematics & Modelling Processes, Statistical Science and Mathematics with Education Studies.

BSc. ACTUARIAL SCIENCE

The BSc Actuarial Science major is aimed to provide students with a strong background in mathematics, statistics, and actuarial science necessary to analyze risks. This three year programme consists of a total of 111 credits.

SEMESTER 1

Code	Title	Credits
MATH1141	Intro. Linear Algebra and Analytic Geometry	3
MATH1142	Calculus I	3
COMP1126	Introduction to Computing I*	3
COMP1127	Introduction to Computing II*	3
ECON1000	Principles of Economics I*	3
ACCT1005	Introduction to Financial Accounting *	3
MATH2701	Financial Mathematics I	3
STAT2001	Inferential Statistics	3
MGMT2023	Financial Management I*	3
MATH3801	Financial Mathematics II	3
MATH3804	Actuarial Mathematics II	3
MATH3805	Mathematics of Pension Funds	3
STAT3001	Regression Analysis	3

SEMESTER 2

MATH1151	Calculus II	3
MATH1152	Introduction to Formal Mathematics	3
COMP1161	Object oriented programming*	3
COMP1220	Computing & Society*	3
EON1012	Principles of Economics II	3
ACCT1003	Introduction to Cost & Management Accounting	3
MATH2401	Elements of Mathematical Analysis	3
MATH2404	Introduction to Probability Theory	3
MATH2410	A first course in Linear Algebra	3
MATH2407	Stochastic Modelling I	3
MATH2420	Introduction of Ordinary Differential Equations	3
MATH2702	Actuarial Mathematics I	3

MATH3802	Construction & Evaluation of Actuarial Models	3
MATH3803	Models for Financial Economics	3
MATH3806	Topics in General Insurance	3
STAT3002	Time Series	3
MGMT3048	Financial Management II	3

(*)Offered both Semester 1&2

A minimum of eleven (11) additional credits should be selected from:

SEMESTER 1

MATH2403	Multivariable Calculus	3
MATH2430	Linear Optimization	3
MATH3414	Selected Topics in Operations Algebra	
MATH3412	Advanced Linear Algebra	3
MATH3421	Partial Differential Equations	
MATH3490	Complex Analysis	3
COMP2140	Software Engineering	3
COMP2180	Web Design & Programming I	3
COMP3110	Information Systems in Organisations	
COMP3180	Web Design & Programming II	3
SOCI2004	Introduction to Population *	
SOCI3018	Demography I	3
ECON2000	Intermediate Microeconomics I	3
ECON2002	Intermediate Macroeconomics I	3

SEMESTER 2

MATH2411	Introduction of Abstract Algebra	3
MATH2431	Non-Linear Optimization	3
MATH3422	Mathematical Modelling	3
MATH3423	Research Project in Mathematics	3
MATH3424	Numerical Methods	3
SOCI3021	Demography II	3
ECON2001	Intermediate Microeconomics II	3
ECON2003	Intermediate Macroeconomics II	3

(*) Offered both Semesters 1&2

BSc. MATHEMATICS AND MODELLING PROCESSES

The BSc Mathematics and Modelling Processes requires passes in MATH1141, MATH1142, MATH1151, MATH1152 (or M10A/MATH1140 and M10B/MATH1150) at Level 1, and a total of 60 credits from Part II these must include 30 credits from Level 2 and 30 credits from Level 3 courses, these must include the following courses:

SEMESTER 1

MATH2401	Elements of Mathematical Analysis	3
MATH2410	A first course in Linear Algebra	3
MATH2421	Fourier Series & Integral Transforms	3
MATH2404	Introduction to Probability Theory	3
MATH2430	Linear Optimization	3
MATH2407	Stochastic Modelling	3
MATH3155	Complex Variables	
MATH3412	Advance Linear Algebra	3
MATH3421	Partial Differential Equations	3

SEMESTER 2

MATH2411	Introduction to Abstract Algebra	3
MATH2403	Multivariable Calculus	3
MATH2420	Ordinary Differential Equations	3
STAT2001	Inferential Statistics	3
MATH3422	Mathematical Modelling	3
MATH3402	A course on Metric Space & Topology	3
MATH3424	Numerical Methods	3
MATH3423	Research Project	3

Electives – 9 credits from below:

SEMESTER 1

MATH3401	Introduction to the Theory of Integration	3
MATH3414	Selected Topics in Operations Research	3
STAT3001	Regression Analysis	3

SEMESTER 2

MATH3411	Advanced Abstract Algebra	3
MATH3403	Some topics in Functional Analysis	3
MATH3404	Introduction to Differential Geometry with Computer Software	3
STAT3002	Time Series	3

BSc. STATISTICAL SCIENCE

The BSc in Statistical Science consists of 3 Levels: Level 1 provides the basic mathematical and statistical skills required for all other aspects of the programme. Levels II & III consist of courses that provide a solid background in both analysis and statistics with practical applications. They are as follows:

Level 1
SEMESTER 1

MATH1141	Introduction to Linear Algebra & Analytical Geometry	3
MATH1142	Calculus I	3
STAT1001	Statistics for Scientists (Elective)	3

SEMESTER 2

MATH1151	Calculus II	3
MATH1152	Introduction to Formal Mathematics	3

Level 2
SEMESTER 1

MATH2401	Elements of Mathematical Analysis	3
MATH2404	Introduction to Probability Theory	3
MATH2410	A first course in Linear Algebra	3

SEMESTER 2

MATH2407	Stochastic Modelling	3
STAT2001	Inferential Statistics	3
STAT2002	Discrete Statistics	3
STAT2003	Linear Models	3
STAT2004	Multivariate Methods	3

Level 3
SEMESTER 1

STAT3001	Regression Analysis	3

SEMESTER 2

STAT3002	Time Series	3
STAT3003	Design & Analysis of Experiments	3
MATH3423	Research Projects	3

Plus 12 credits from the following elective courses below:

SEMESTER 1

MATH2421	Fourier Series and Integral Transforms	3
MATH2430	Linear Optimization	3
MATH3155	Complex Variables	3
MATH3410	Advanced Linear Algebra	3
MATH3414	Selected Topics in Operations Research	3
MATH3421	Partial Differential Equations	3
MATH3801	Financial Mathematics II	3
MATH3804	Actuarial Mathematics II	3
MATH3805	Mathematics of Pension Funds	3

SEMESTER 2

MATH2403	Multivariable Calculus	3
MATH2411	Introduction to Abstract Algebra	3
MATH2420	Ordinary Differential Equations	3
MATH2431	Non-Linear Optimization	3
MATH2702	Actuarial Mathematics I	3
MATH3422	Mathematical Modelling	3
MATH3424	Numerical Methods	3
MATH3802	Evaluation of Actuarial Models	3
MATH3803	Models for Financial Economics	3
MATH3806	Topics in General Insurance	3

BSc. MATHEMATICS WITH EDUCATION STUDIES

In the BSc in Mathematics with Education Studies students pursuing the programme are required to take a minimum of 60 advanced credits.

INITIAL TEACHER TRAINING

Level 1: Minimum of eighteen (18) Faculty and Mathematics credits as follows:
Semester 1
MATH1141: Introductory Linear Algebra & Analytic Geometry
MATH1142: Calculus I
EDTL1020: Introduction to Teaching and Learning
EDPS1003: Psychological Issues in the Classroom

Semester 2
MATH1151: Calculus II
MATH1152: Introduction to Formal Mathematics
EDTL1021: Planning for Teaching
Plus (6 credits optional) in-faculty courses.

Level 2: Eighteen (18) Mathematics credits as follows:
Semester I
MATH2401: Elements of Mathematical Analysis
MATH2410: A First Course in Linear Algebra
MATH2404: Introduction to Probability Theory
EDMC2213: Children Learning Mathematics
EDMA2214: The Nature and Scope of Mathematics
Core mathematics education course (3 credits)

Semester 2
STAT2001: Inferential Statistics
MATH2403: Multivariable Calculus
MATH2420: Ordinary Differential Equations
EDMA2216: Analysis and Teaching of Mathematics
EDTL2021: School Based Experience I

Level 3: Eighteen (18) Mathematics credits as follows:
Semester 1
EDTL3017: Field Study (School Based Experience I)
MATH3425: Techniques for Solving Advanced Problems
Plus any TWO level 2 or level 3 Mathematics Courses

Semester II
EDRS3019: Report
EDME3205: Teaching Mathematics in Grades 10 and 11;
Plus any THREE level 2 or level 3 Mathematics courses

TRAINED TEACHERS
Teachers admitted under the trained teacher strand will be exempted from the preliminary mathematics education courses listed in the schematic for initial teacher training above. Any exemption would be afforded on an individual basis, based on the applicant's qualification. Students admitted under this programme should be able to complete it in two years with 30 advanced mathematics credits. Otherwise, the programme will take three years as per the initial teacher training programme structure.

Level 1: (A minimum of 18 Level 1 In-Faculty credits are required as follows.
Semester I
MATH1141: Introductory Linear Algebra & Analytic Geometry
MATH1142: Calculus I
EDMC2213: Children Learning Mathematics
EDMC2214: The Nature and Scope of Mathematics

Semester 2
MATH1151: Calculus II
MATH1152: Introduction to Formal Mathematics
EDMA2216: Analysis and Teaching of Mathematics

Summer Semester
MATH2401: Elements of Mathematical Analysis
MATH2410: A First Course in Linear Algebra
Plus (6 credits optional) In-faculty courses.

Level 2
Semester 1
MATH3425: Techniques for Solving Advanced Problems
Plus any TWO level 2 or level 3 mathematics courses
EDTL3020: Preparing for the Field: The Teacher as Researcher
EDTL3021: In the Field: Teaching as Experiment
Core education course (3 credits)

Semester 2
STAT2001: Inferential Statistics
MATH2403: Multivariable Calculus
MATH2420: Ordinary Differential Equations
Plus any ONE level 2 or level 3 mathematics courses
EDME3205: Teaching Mathematics in Grades 10 & 11
EDRS3019: Report

Summer Semester
MATH2404: Introduction to Probability Theory

MAJOR IN MATHEMATICS

A major in Mathematics requires passes in MATH1141, MATH1142, MATH1151, MATH1152 (or M10A/MATH1140 and M10B/MATH1150) at Level 1. This major has a weighting of thirty six (36) advanced credits.

Level 2
SEMESTER 1

MATH2401	Elements of Mathematical Analysis	3
MATH2410	A First course in Linear Algebra	3
MATH2404	Introduction to Probability Theory	3

SEMESTER 2

MATH2411	Introduction to Abstract Algebra	3

MATH2403	Multivariable Calculus	3
MATH2420	Ordinary Differential Equations	3

Level 3
SEMESTER 1

MATH3155	Complex Variables	3
MATH3412	Advanced Linear Algebra	3

SEMESTER 2

MATH3402	A course on Metric Spaces & Topology	3

Plus any three Level 3 courses from the following electives:

SEMESTER 1

MATH3414	Selected Topics in Operations Research	3
MATH3421	Partial Differential Equations	3

SEMESTER 2

MATH3422	Mathematical Modelling	3
MATH3403	Some Topics in Functional Analyses	3
MATH3424	Numerical Methods	3
MATH3423	Research Project	3
MATH3411	Advanced Abstract Algebra	
MATH3404	Introduction to Differential Geometry	3
	with Computer Software	3
STAT3002	Time Series	3

MINOR IN MATHEMATICS

A minor in Mathematics requires passes in MATH1141, MATH1142, MATH1151, MATH1152 (or M10A/MATH1140 and M10B/MATH1150) at Level I, plus eighteen (18) advanced credits as indicated below:

Level 2
SEMESTER 1

MATH2401	Elements of Mathematical Analysis	3
MATH2410	A First Course in Linear Algebra	3

Level 2
SEMESTER 1

MATH3155	Complex Variables	3
MATH 3412	Advanced Linear Algebra	3

Plus any two courses from the Math Elective List below:

MATHS ELECTIVE:

SEMESTER 1
MATH2430 - Linear Optimization
MATH2404 - Introduction to Probability Theory
MATH2421 - Fourier Series & Integral Transforms
MATH2403 - Multivariable Calculus
STAT3001 - Regression Analysis
MATH3414 - Selected Topics in Operations Research
MATH3421 - Partial Differential Equations
MATH3401 - Introduction to the Theory of Integration
MATH3404 - Introduction to Differential Geometry with Computer Software

SEMESTER 2
MATH2411 - Introduction to Abstract Algebra
STAT2001 - Inferential Statistics
MATH2407 - Stochastic Modelling
MATH2420 - Ordinary Differential Equations
MATH2431 - Non-Linear Optimization
MATH3402 - A Course on Metric Space & Topology
MATH3422 - Mathematical Modelling
MATH3424 - Numerical Methods
MATH3403 - Some Topics in Functional Analysis
MATH3411 - Advanced Abstract Algebra
STAT3002 - Time Series

COURSE DESCRIPTION

M08B/MATH0100 **PRE-CALCULUS**

(6 P-Credits) Semester 1 Level 0

Pre-requisite: CSEC Mathematics or equivalent

Course Content: This course covers the following topics:

- **Algebra**: Real numbers, surds; complex numbers; linear, quadratic, and polynomial equations; inequalities; functions and their graphs; transformations and periodic functions; inverse functions; logarithms and exponentials;
- **Trigonometry**: The six trigonometric functions and their interrelations; the addition formulas; the double- and half-angle formulas; trigonometric identities; the inverse trigonometric Functions; the solution of triangles;

Evaluation:

- One 3-hours written paper 70%
- Two midterm exams 30%

M08C/MATH0110 **CALCULUS AND ANALYTICAL GEOMETRY**

(6 P-Credits) Semester 2 Level 0

Pre-requisite: CSEC Mathematics or equivalent

Course Content: This course covers the following topics:

- **Function Theory**: limits, continuity; implicitly defined functions; review of inverse function theory;
- **Differentiation**: Definition of the derivative, examples; the derivative of a sum, difference, product, and quotient of two functions; the chain rule; derivatives of polynomials, the trigonometric functions, logs, exponentials, and the inverse trigonometric functions; higher-order derivatives; first-order separable differential equations;

- **Applications of the Derivatives**: Local maxima and minima; the second-derivative test; global maxima and minima; maximization on a closed interval; curve sketching;
- **The Definite Integral**: Definition of the integral, examples; the Fundamental Theorem of Calculus; antiderivatives; u-du substitutions; integration by parts; changes of variable for the definite integral;
- **Applications of the Integral**: Volumes by cross sections and cylindrical shells; arc-length; surface areas of revolution;

Evaluation**:**

• One 3-hours written paper	70%
• Two midterm exams	30%

Successful completion of M08B/MATH0100 and M08C/MATH0110 is not sufficient for entry to the BSc Degree programme in Engineering. Students can apply for a transfer to the Faculty of Engineering on the successful completion of M10A/MATH1140 and M10B/MATH1150.

MATH1141 — **INTRODUCTORY LINEAR ALGEBRA AND ANALYTIC GEOMETRY**

(3 Credits) Semester 1 and 2 Level 1

Pre-requisites: CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110, or equivalent

Course Content**:** This course covers the following topics:

- **Function**: Definition, inverse function, graphs of some elementary functions and elementary transformations of the graphs. Systems of linear equation: solutions of systems of linear equations, the Gauss-Jordan elimination algorithm; inconsistent and over determined systems; homogeneous systems of equations; row and column vectors;
- **Matrices**: elementary matrix operations, determinant, Cramer’s rule and linear systems of equations. Vector geometry;

- **Vectors in 2 and 3 dimensions**: vector equations of lines and planes; dot products, cross products;

Evaluation:

- One 2-hours written paper 70%
- Course work 30%

MATH1142 **CALCULUS I**

(3 Credits) Semester 1 Level 1

Pre-requisites: CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110, or equivalent

Course Content: This course covers the following topics:

- **Limits and Continuity**: limit of function, continuity and properties of continuous functions;
- **Differentiability and Application of Derivatives**: derivatives of functions, product, quotient and chain rule, application of derivatives, L'Hospital's rule, Taylor's formula and Taylor polynomials; maxima, minima and inflection points; detailed investigation of a function and construction of its graph;
- **Integration**: the definite integral as a Riemann sum and properties of the definite integral; fundamental theorem of calculus, the indefinite integral; methods of integration; applications of integration: areas and volumes;

Evaluation:

- One 2-hours written paper 70%
- Course work 30%

MATH1151 **CALCULUS II**

(3 Credits) Semester 2 Level 1

Pre-requisite: MATH1142

Course Content: This course covers the following topics:

- **More methods of integration**: integration of expressions containing radicals, integration of expressions containing trigonometric functions and trigonometric substitution; application of integration in solving first order differential equations;
- **Partial Differentiation**: functions of several variables, gradient vector, directional derivatives, and the tangent plane, variation of parameters; polar, cylindrical and spherical coordinate; constrained and unconstrained optimization, including Lagrange multipliers;
- **Multiple Integrals**: double integrals, heuristics and reversing the order of integration; line, surface and volume integrals;

Evaluation:

- One 2-hours written paper 70%
- Course work 30%

MATH1152 **INTRODUCTION TO FORMAL MATHEMATICS**

(3 Credits) Semester 1 Level 1

Pre-requisite: CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110, or equivalent

Course Content: This course covers the following topics:

- **Formal Symbolic Logic**: statement, negation, truth tables, case-by-case analysis, proof by contradiction. Sets, Relations and Equivalence;
- **Relations**: basic set theory, relations and their properties, equivalence relations, equivalence classes;

- **Binary Operations**: operations as mappings, associativity and commutativity, identity elements and inverses. Natural numbers: the axioms, addition, multiplications of natural numbers, elementary proofs, the Principle of Mathematical Induction;
- **The Integers**: the axioms, elementary proofs, divisibility, the unique prime factorization of an integer, reminder classes;
- **The Real Numbers**: the axioms of addition and multiplications, the distributive law, the axioms of order and completeness.

Evaluation:

- One 2-hours written paper 60%
- Course work 40%

MATH1185 **CALCULUS FOR SCIENTISTS AND ENGINEERS**

(3 Credits) Semester 1 and 2 Level 1

Pre-requisites: CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110, or equivalent

Course Content: This course covers the following topics:

- Limits, Continuity and Differentiability. Application of derivatives. Integration. Ordinary differential equations. Functions of several variables. Multiple integrals. Series.

Evaluation:

- One 2-hours paper 70%
- Course work 30%

STAT1001 **STATISTICS FOR THE SCIENTISTS**

(3 Credits) Semester 1and 2 Level 1

Pre-requisites: CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110, or equivalent

Course Content: This course covers the following topics:

- Summarising and Interpreting Data. Random Variables. Probability and Probability Distribution. Elementary ideas of sampling methods. Sampling and Estimation. Confidence Intervals. Hypothesis Testing; Chi-square Test. Introduction to Simple Linear Regression.

Evaluation:

- One 2-hours written paper 60%
- Course work 40%

MATH 1180 **ENGINEERING MATHEMATICS I**

(3 Credits) Semester 1 Level 1

Pre-requisite: CAPE or GCE A-Level Mathematics, or M08B/MATH0100 and M08C/MATH0110, or equivalent

Course Content: This course covers the following topics:

- Calculus and Algebra, functions of one variable: limits, continuity, differentiation, integration, mean value theorems; Taylor and Maclaurin expansions. Functions of two variables. Vectors: dot, cross and mixed products; geometrical problems-lines, planes. Matrices: properties, solution of linear equations. Complex Numbers: polar presentation. Ordinary differential equations: first order equations, separation of variables, integrating factor, second order linear equations with constant coefficients. The Laplace transform: step functions and derivatives, the inverse transform.

Evaluation:

- One 2-hours written paper 75%
- Two midterm exams 25%

This course is designed for students majoring in Electronics Engineering only.

STAT 2001 **INFERENTIAL STATISTICS**

(3 Credits) Semester 1 Level 1

Pre-requisites: STAT1001 or MATH2104

Course Content: This course covers the following topics:

- **Sampling Distributions**: Distribution of the sample mean and proportion(large sample size):-Sum and differences of sample mean, Sum and difference of sample proportion, Hypothesis testing and confidence intervals; Distribution of the sample mean and variance(small sample size):- One-and two sample t-test, paired test, Test concerning variances, Hypothesis testing and confidence intervals;
- **Parameter Estimation**: Unbiasedness, bias, mean square error, consistency, efficiency, sufficiency, Minimum unbiased variance, Cramer-Rao lower bound, Likelihood and log-likelihood functions, maximum likelihood estimator, method of moments, properties of maximum likelihood, Rao-Blackwell theorem, Fisher-Neyman criterion, factorisation theorem;
- **Interval Estimation**: Random intervals and sets, use of pivotal quantities, use of asymptotic results; Relationship between hypothesis tests and confidence intervals; graphical confidence interval;
- **Hypothesis Testing**: Simple and Composite hypotheses, Types of Error, Power of test, p-value; Neyman-Pearson method, Generalised Likelihood Ratio Test; Use of asymptotic results to construct tests: - Central Limit theorem, asymptotic distributions of

maximum likelihood estimator and generalised likelihood ratio test statistic;

- **Goodness-of-fit Test**: goodness-of-fit test of standard distributions:- binomial, geometric, Poisson, negative binomial, truncated Poisson, uniform, normal, exponential and gamma to observed data;

Evaluation:

- One 2-hours written examination 70%
- Two mid-term examination 30%

<u>MATH 2401</u> **<u>ELEMENTS OF MATHEMATICAL ANALYSIS</u>**

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

Pre-requisites: **(**MATH1141, MATH1142, MATH1151 and MATH1152) or (M10A, M10B)

Course Content**:** This course covers the following topics:

- **Sequences:** The least upper and the greatest lower bounds; the Completeness axiom, sequences, limits; bounded, monotone and Cauchy sequences; Convergence theorem; subsequence; the Bolzano-Weierstrass theorem; limsup, liminf;
- **Limits and Continuity:** The limit of functions, left and right limits, properties; lim sin x/x, and lim(1+x)^x; continuity, different types of discontinuity; properties of continuous functions on close interval; intermediate and extreme values; uniform continuity;
- **Differentiability:** Derivative; the Mean-Value theorem; inverse function;
- **Infinite Series**: Convergence of infinite series; the divergence test, positive series tests (comparison, limit comparison, ratio, root); absolute convergence; alternating series; Cauchy criterion for convergence;
- **Sequence and Series of functions:** The pointwise convergence of a sequences of functions; uniform convergence of sequences of functions; uniform convergence of series of functions; convergence of power series;

Abel's and Weierstrass's tests; functions defined by power series; Taylor series;

Evaluation:

- Final exam: 2-hours written paper 70%
- Two midterm exams (10% each) 20%
- Two written assignments (5% each) 10%

MATH 2403 **MULTIVARIABLE CALCULUS**

(3 Credits) Semester 2 Level 2

Pre-requisites**:** (MATH1141, MATH1142 and MATH1151) or (MATH1185) or (M10A and M10B)

Course Content: This course covers the following topics:

- **Parametric and Polar curves:** Parametric Equations - Polar coordinates - Conic sections ;
- **Vectors and Vector valued Functions:** Vectors in 2D and 3D, dot and cross products, Lines and curves in space, Calculus of Vector valued functions, Motion in space, Length of curves, Curvature and normal vector;
- **Functions of Several Variables:** Planes and Surfaces, Graphs and level curves, Review: Limits, continuity and Partial derivatives, Directional derivatives and Gradient, Tangent planes, Maxima/Minima;
- **Multiple Integration:** Review: Double and triple integrals, Polar, cylindrical and spherical coordinates;
- **Vector Calculus:** Vector fields, Line integrals, Green's theorem, surface integrals, Stokes theorem, Divergence theorem;

Evaluation**:**

- Two midterm examination 30%
- One final written examination 70%

MATH2404 **INTRODUCTION TO PROBABILITY THEORY**

(3 Credits) Semester 1 Level 2

Pre-requisites: (MATH1141, MATH1142, MATH1151 & MATH1152) or (M10A & M10B)

Course Content: This course covers the following topics:

- **Review of basic notions of probability:** Notions of random phenomena, event, outcome, working definition of probability; Combinatorial techniques, permutations and combinations; Probability of intersection and union of events; mutually exclusive and exhaustive events, complimentary events; Conditional probability, Independence, the total probability rule, Bayes' theorem;
- **Discrete Random Variables:** Probability density function, cumulative distribution function; Binomial, uniform, geometric, Poisson distributions; Multidimensional random variables, joint density, marginal density; Independence; Expectation, moments, variance and standard deviation; Covariance and correlation coefficient. Uncorrelated random variables;
- **Continuous Random Variables:** Probability density function, probability distribution function; Uniform, Normal, exponential and gamma distributions; Expectation, moments, variance and standard deviation; Moment generating function;
- **Asymptotic Theory:** Chebishev's inequality; Weak Law of Large Numbers; Central Limit Theorem; Normal and Poisson approximations;

Evaluation:

- One 1 hour In-course test 15%
- Two assignments 15%
- One 2-hours final written examination 70%

MATH2407 **STOCHASTIC MODELING**

(3 Credits) Semester 2 Level 2

Pre-requisite: MATH2404

Course Content: This course covers the following topics:

- **Introduction:** Significant discrete and continuous random variables and their probability distributions; Sums of random variables: convolution and their distribution; Conditional probability and conditional expectation; Introduction to stochastic processes: definition, time set & state space classifications;
- **Markov Processes:** Time homogeneous and inhomogeneous Markov chain: one-step transition probabilities, one-step transition matrix, kth-step transition probabilities, limiting distributions; Random walk: absorbing states, first passage times, mean time to absorption, recurrence, Gambler's Ruin problem; The homogeneous Poisson process: exponential successive inter-arrival times; waiting times, sojourn times, transition times;
- **Queues:** The Bernoulli single server queuing process: limited and unlimited capacity queues, arrival process, service process; M/M/1 queuing process, limiting distributions; M/M/k queuing process;
- **Brownian Motion:** Motivation and definition; Properties: the reflection principle, first hitting times, zeros of Brownian motion; Brownian motion with drift;
- **Laboratory Work:** Probability basics, random variables and distributions; Pseudo-random number generators; Markov chains, Poisson processes, queues and Brownian motion: applications and simulation; Supervised group project work;

Evaluation:

- One In-course test 20%
- One Group project 20%
- Final theory exam [2 hours] 60%

<u>MATH2410</u> **<u>A FIRST COURSE IN LINEAR ALGEBRA</u>**

(3 Credits) Semester 1 Level 2

Pre-requisites: MATH 1141 & MATH 1152 or M10A & M10B

Course Content: This course covers the following topics:

- **Properties of Matrices and Determinants :** Review matrices and systems of linear equations, row equivalence, the sigma-notation definition, proof of familiar results;
- **Vector Spaces:** Definition, independence, basis and dimension;
- **Linear Transformations:** Definition, Kernel and image, Invertible operators ;
- **Inner Products:** Definition, Cauchy-Scharz, orthogonality, projections, Gram-Schmidt;
- **Eigenspaces:** Characteristic polynomials, Cayley-Hamilton, eigenvalues and eigen-vectors, diagonalization of matrices;

Evaluation**:**

- Mid-semester examination 20%
- Graded Assignments 10%
- 2 hours final written examination 70%

<u>MATH2411</u> **<u>Introduction to Abstract Algebra</u>**

(3 Credits) Semester 2 Level 2

Pre-requisites: MATH1141 & MATH1152 or M10A & M10

Course Content: This course covers the following topics:

- **Permutations:** Order, parity, transpositions;
- **Groups :** Definition and examples, Lagrange Theorem, Homomorphisms, Quotient Groups;
- **Rings:** Definition and examples of rings;

- **Fields:** Definition and examples, polynomials of fields;

Evaluation**:**

- 2 hours final written examination 70%
- Midterm examination 30%

MATH2420 **ORDINARY DIFFERENTIAL EQUATIONS**

(3 Credits) Semester 2 Level 2

Pre-requisites**:** (MATH1141, MATH1142, MATH1151 & MATH1151) or (M10A & M10B)

Course Content: This course covers the following topics:

- **Classification of Differential Equations:** Ordinary and partial differential equations, systems of differential equations, order of a differential equation, linear and nonlinear equations, what is a solution of a differential equation;
- **First Order Differential Equations:** Linear equations with variable coefficients, separable equations, test of exactness, non-exact differential equations and integrating factors, the existence and uniqueness theorems for first-order linear and nonlinear differential equations (without proofs), interval of definition, differences between linear and nonlinear equations, Picard's method of successive approximations;
- **Higher Order Linear Equations:** Homogeneous equations with constant coefficients, fundamental solutions of linear homogeneous equations, linear independence and the Wronskian, complex roots of the characteristic equation, repeated roots, reduction of order, nonhomogeneous equations and general formula for the solution involving the Wronskian;
- **Power series solutions:** Short review of power series and convergence tests, Taylor series and analytic functions, standard form of second order linear differential equations, ordinary and singular points,

power series solution of second order linear differential equations around a regular point, recurrence relation, gymnastics in shifting the index of summation; regular and irregular singular points, method of Frobenius, the indicial equation and the exponents at the singularity;

- **Legendre polynomials and Bessel functions:** Fuchs theorem, general considerations on the convergence radius of series solutions for the Legendre and Bessel equations around an ordinary point, elementary and special functions, the Legendre equation: solutions around x=0, Legendre polynomials; Bessel equation of order ν, Bessel functions of fractional order, Bessel function of order zero of the first kind, Bessel function of order ν of the first kind and its asymptotic behaviour for large x, Gamma function and Bessel function of arbitrary order;

Evaluation**:**

- Two midterm examinations: 30%
- 2 hours final written examination 70%

MATH 2421 **FOURIER SERIES AND INTEGRAL TRANSFORMS**

(3 Credits) Semester 1 Level 2

Pre-requisites: (MATH1141, MATH1142 & MATH1151) or (MATH1185) or (M10A & M10B)

Course Content**:** This course covers the following topics:

- **Fourier Series:** Introduction, Fourier series expansion of a function and determination of Fourier coefficients, Continuous and discontinuous functions and its expansion in Fourier series , Existence of Fourier series of a function; Examples: Expressing the given function in terms of Fourier series; Fourier series – even and odd functions; Fourier series in an arbitrary interval; Even and odd periodic continuation – Half-range Fourier sine and cosine expansions;

- **Laplace Transforms:** Introduction, Definition and properties of Laplace transforms; Laplace transform of some standard functions; Finding the transform of a given function – examples; Definition of inverse transform and properties; examples, convolution theorem, Applications of Laplace transforms in solving differential equations;
- **Fourier Transforms:** Fourier integral theorem, Fourier sine and cosine integrals; Fourier transform and properties; Fourier sine and cosine transforms – properties; Inverse transforms – Finite Fourier transforms; Applications in solving Differential equations;
- **Special functions:** Gamma functions and properties; Beta function and properties; Relations between beta and gamma functions;

Evaluation:

- Two midterm examinations 20%
- 5 Take home assignments 20%
- Final written examination [2 hours] 60%

MATH 2430 **LINEAR OPTIMIZATION**

(3 Credit) Semester 2 Level 2

Pre-requisites: (MATH1141 & MATH1152) or (M10A & M10B)

Course Content: This course covers the following topics:

- **Linear programming Introduction and formulation:** Introduction, Phases of Operations Research;
- **Graphical Method:** Solving linear programming by graphical method and examples ;
- **Simplex Method:** Algorithm and algebraic interpretation; Examples general case and Special Cases;

- **Big M Method:** Method and examples
- **Two Phase Method -** Method, Examples on different cases;
- **Duality:** Dual form of given primal problem and examples; Duality theorems, Primal Dual relations; Complementary Slackness Theorem Proof, Applications;
- **Sensitivity Analysis:** Sensitivity analysis with Graphical Method; Sensitivity analysis through simplex method;
- **Transportation and assignment models -** Transportation Models introduction and modeling as a Linear programming Problem, initial solutions, Transportation simplex method; Introduction, examples of Assignment models , Hungarian method of solution and examples;

Evaluation**:**

- Two midterm examinations 30%
- Final written examination (2 hours) 70%

MATH 2431 **NON-LINEAR OPTIMIZATION**

(3 Credits) Semester 1 Level 2

Pre-requisites**:** (MATH1141 & MATH1142) or (M10A & M10B)

Course Content: This course covers the following topics:

- **Optimization of functions of several variables:** Examples of optimization problems, unconstrained optima (first and second order conditions), constrained optima, the Lagrange method;
- **Non-linear programming problems:** Inequality constraints, Kuhn-Tucker Multipliers;

Evaluation:

- One midterm examination 20%
- Two take home graded assignments 10%
- Final written examination (2 hours) 70%

MATH 2701 **FINANCIAL MATHEMATICS I**
(3 Credits) Semester 2 Level 2

Pre-requisites: (MATH1141, MATH1142, MATH1151 & MATH1152) or (M10A & M10B)

Course Content: This course covers the following topics:

- **Basic Interest Theory – Time Value of Money**: Interest rate, simple interest/discount, compound interest/discount, accumulation function. Future value, present value, net present value, discount factor; Convertible mth-ly, nominal rates of interest/discount; Inflation and real interest; force of interest; Equivalent interest measures, equation of value;
- **General Cash Flow and Portfolios**: Yield rate/ rate of return, dollar-weighted rate of return, time-weighted rate of return, current value;
- **Annuities with non-contingent payments**: Annuity immediate, annuity-due, perpetuity; Payable mth-ly, payable continuously; Level payment annuity, arithmetic increasing/decreasing payment annuity, geometric increasing/decreasing annuity;
- **Basic Applications**: Loans and amortization schedules; Valuation of bonds; Stock Valuation;

Evaluation:

- Final written examination (2 hours) 75%
- Midterm examination 25%

MATH 2702 **ACTUARIAL MATHEMATICS I**
(3 Credits) Semester 2 Level 2

Pre-requisites: MATH2701 and MATH2404
Course Content: This course covers the following topics:

- **Survival Models:** Decrements: Common decrements; select, ultimate and aggregate decrements and their applications (general population versus insured population, life insurance versus annuity; individual versus group life insurance; pricing versus valuation; historic versus projected;

- Models used to model decrements in insurance, annuities and investments; probabilities based on these models; time-to-decrement, age-to-decrement, and cause-of-decrement random variables;
- Density, distribution and survival functions: age at death, select and ultimate life tables, fractional ages (include linear, exponential, hyperbolic), mortality laws (uniform, exponential, Makeham, Gompertz); force of decrement;
- **Life insurances and Annuities:** Life insurance: actuarial present value function (apv), moments of apv, basic life insurance contracts, portfolio; Life annuities: actuarial accumulation function, moments of apv, basic life annuities. Non-interest-sensitive insurances (disability income, product warranty, defined benefit pension plans, health insurance); interest-sensitive insurances (universal life, variable annuities);
- **Premiums:** Net annual premiums: actuarial equivalence principle, loss function, accumulation type benefits;

Evaluation:

- Midterm Examination 25%
- Final written examination (2 hours) 75%

STAT 2001 **INFERENTIAL STATISTICS**

(3 credits) Semester 1 Level 1

Pre-requisite: STAT1001 or MATH2404

Course Content: This course covers the following topics:

- **Sampling Distributions**: Distribution of the sample mean and proportion(large sample size):-Sum and differences of sample mean, Sum and difference of sample proportion, Hypothesis testing and confidence intervals; Distribution of the sample mean and variance(small sample size):- One-and two sample t-test, paired test, Test concerning variances, Hypothesis testing and confidence intervals

- **Parameter Estimation**: Unbiasedness, bias, mean square errorconsistency, efficiency, sufficiency, Minimum unbiased variance, Cramer- Rao lower bound, Likelihood and log-likelihood functions, maximum likelihood estimator, method of moments, properties of maximum likelihood, Rao-Blackwell theorem, Fisher-Neyman criterion, factorisation theorem.

- **Interval Estimation**: Random intervals and sets, use of pivotal quantities, use of asymptotic results; Relationship between hypothesis tests and confidence intervals; graphical confidence interval

- **Hypothesis Testing**: Simple and Composite hypotheses, Types of Error, Power of test, p-value; Neyman-Pearson method, Generalised Likelihood Ratio Test; Use of asymptotic results to construct tests: - Central Limit theorem, asymptotic distributions of maximum likelihood estimator and generalised likelihood ratio test statistic

- **Goodness-of-fit Test**: goodness-of-fit test of standard distributions:- binomial, geometric, Poisson, negative binomial, truncated Poisson, uniform, normal, exponential and gamma to observed data

Evaluation:

- One two-hour examination 70%
- Two mid-term examination 30%

STAT2002 **DISCRETE STATISTICS**

(3 Credits) Semester 2 Level 2

Pre-requisites: STAT1001, MATH1142

Course Content: This course covers the following topics:

- **Introduction:** Advantages and Disadvantages of Nonparametric Methods
- **Scales of Measurements:** Nominal, Ordinal, Interval and Ratio; Weak measurement versus Strong statistics; Mosteller and Tukey Data Types
- **Inference on Location:** Signed test, Wilcoxon signed rank, Wilcoxon S um rank, Mann-Whitney U.
- **Inference on Dispersion:** Siegel-Tukey test, Freund-Ansari test and Mood's test
- **Rank Correlation:** Spearman's rank:- treatment of ties and no ties and Kendall's rank
- **Test of Randomness:** Run test, Chi-square test,
- **Goodness of Fit:** Kolmogorov-Smnirov test, Lilliefor's test, Chi-square test
- **Design of Experiment:** Kruskal-Wallis test, Freidman's test, Kendall's concordance
- **Categorical Data:** Contingency tables, Fisher's exact test, McNemar test, Mantel-Haenszel test

Evaluation:

- Mid-term Examination (1 Hour) 15%
- Problem Papers/Lab Assignments 15%
- Final Examination (2 Hours) 70%

STAT2003 **LINEAR MODELS**

(3 Credits) Semester 2 Level 2

Pre-requisites: STAT1001, STAT2001

Course Content: This course covers the following topics:

- **Exploratory Data Analysis:** numerical summaries:-mean, median, mode, trimmed mean,quartiles, range, variance, standard deviation, percentiles, skewness, kurtosis, semi-interquartile range, inter-quartile range, coefficient variation; graphical summaries:-Dotplot, Stem-and-Leaf diagram, Box-and-Whisker plot, Rootograms, Radar/Spider plots, Matrix plot; Quantile function:-theoretical distributions and empirical distributions, QQ plots; Parameter estimation: bootstrap method
- **Linear Regression:** Median polishing technique, Resistant method for fitting straight line, Additive models:- structure and fitting, Polynomial regression;
- **Logistic Regression:** Introduction, fitting simple model, Inferences:- confidence interval, significance testing; Multiple Logistic regression, Odds ratios, Interpretation of fitted logistic models; Assessing model: Goodness-of-fit, Pearson's chi-square statistic and deviance, diagnostic measures, validation; Case-control studies Application
- **Analysis of Variance:** One-way and Two-way Analysis of variance with and without interaction, Additive models, Regression approach to ANOVA

Evaluation:

- Project 1 40%
- Project 2 40%
- Problem Papers (about 2) 20%

STAT2004 **MULTIVARIATE METHODS**

(3 Credits) Semester 2 Level 2

Pre-requisites: STAT1001, MATH1141, MATH2410

Course Content: This course covers the following topics:

- **Introduction:** areas of application, organisation of data, graphical techniques, geometry interpretation
- **Matrix Algebra & Random Vectors**: Introduction, Review of matrix and vector algebra; Positive definite matrix; Random vectors and matrices; Mean vectors and Covariance matrices
- **Multivariate Normal Distribution:** Introduction, Density and its properties, Maximum likelihood estimators of μ and $\sum$
- **Inferences:** Sampling distribution of $\bar{X}$ and S, Hotelling's T^2, and Confidence regions
- **Methods:** Principal Component Analysis, Discriminant Analysis, Factor Analysis, Canonical Correlation Analysis and Cluster Analysis

Evaluation:

• Mid-term Examination	15%
• Problem Papers/Lab Assignments (about 5)	15%
• Final Examination	70%

MATH3155 **COMPLEX VARIABLES**

(3 Credit) Semester I Level 3

Pre-requisite: MATH2401

Course Content: This course covers the following topics:

- **Review of complex numbers:** Algebraic and geometric representation of complex numbers; Euler's formula; Rational powers and roots of complex numbers; Regions in the complex plane.

- **Analytic functions:** Limits, continuity and differentiability; Cauchy Riemann equations; Analytic and harmonic functions;
- **Elementary functions:** The complex exponential function; Trigonometric and Hyperbolic functions and inverses; The complex logarithm – definition, properties, branches and branch cuts; Complex powers.
- **Integrals:** The contour integral – definition, properties, application;
- Bounds on integrals; Antiderivatives; The Cauchy-Goursat theorem and the principal of deformation of path, Cauchy's integral formula; Cauchy's inequality and the Maximum Modulus Principle;
- **Series:** Convergence of sequences and series; Power series – absolute and uniform convergence, integration and differentiation; Taylor and Laurent series;
- **Residues and Poles -** Isolated singular points, residues and the Residue Theorem; Classifying isolated singular points; Residues at poles; Evaluation of improper real integrals by contour integration around poles.

Evaluation:

- Two assignments – 10% each 20%
- One in-course test 20%
- Final Examination (2 hours) 60%

MATH 3401 **INTRODUCTION TO THE THEORY OF INTEGRATION**

(Credits 3) Semester 1 Level 3

Pre-requisite: MATH2401

Course Content: This course covers the following topics:

- **Reimann Integral:** Definition and existence of the definite integral. Darboux sums. Upper and low sums. Mean Value theorems. Reimann integral as a function of the upper limit. The Dirichlet function.

- **Measurable Sets On A Line:** Open and Closed Sets, Intuitive meaning of Lebesgue measure; Sets of Measure Zero; Compact Sets, Heine-Borel Theorem.
- **Lebesgue Integral:** Step functions on an Interval, the integral of the step function; properties; upper functions on the interval; Lebesgue integrable functions on the interval; properties, Lebesgue integral on a set of measure zero; connection with Riemann integration; integral of the Dirichlet function.
- **Monotone and Dominated Convergence Theorems:** Monotone convergence theorem for step functions, for upper functions and for Lebesgue integrable fuctions on the interval, Lebesgue's Theorem, consequences of Lebesgue's Theorem.

Evaluation:

- One in course test (1 hour) 20%
- Two assignments 10% each 20%
- Final Examination (2 hours) 60%

MATH 3402 **A COURSE ON METRIC SPACES AND TOPOLOGY**

(3 Credits) Semester 2 Level 3

Pre-requisite: MATH2401

Course Content: This course covers the following topics:

- **Metrics:** Definition and examples, open neighbourhoods, continuity via neighbourhoods, neighbourhoods and convergence in metric spaces, limits, Cauchy sequences, completeness.
- **Topology:** Definition of a topology, metric topologies, examples, continuous functions and closed sets, homeomorphisms, topological and non-topological properties, subspaces, productand, Hausdorff spaces.

- **Compactness:** Definition using open sets, examples, the compact subsets of the real line, continuous images of compact sets, quotient spaces, continuous real valued functions on a compact space, the product of two compact spaces, the compact subsets of Euclidean space, sequential compactness.
- **Connectedness:** Definition using open sets and integer valued functions, examples, components, path-connectedness.

Evaluation:

• One in course test (1 hour)	20%
• Two assignments (10% each)	10%
• Final Examination	60%

MATH 3403 **SOME TOPICS IN FUNCTIONAL ANALYSIS**

(3 Credits) Semester 2 Level 3

Pre-requisite: MATH2401

Course Content: This course covers the following topics:

- **Normed vector spaces**: Metric Spaces; Definition and examples of normed vector spaces, H¨older and Minkovkii inequalities; Completeness, Banach Space; finite dimensional vector spaces, C[a,b], Lp, lp spaces.
- **Hilbert spaces:** Definition of inner product, properties; Hilbert space, connection to Banach and metric spaces; examples, Orthogonality, Cauchy-Schwartz inequality, Parallelogram rule; Theorem of Pythagoras; Bessels inequality.
- **Linear functionals**: Definition of linear functional, properties; Theorem of Hahn-Banach (real version); examples;
- **Linear Operators**: Linear operators: examples; Continuous and bounded operators, Norm of operator, Space of operators.

Evaluation:

- One in-course test (1 hour) 20%
- Two Assignments 10% each 20%
- Final Examination (2 hours) 60%

MATH3404 **INTRODUCTION TO DIFFERENTIAL GEOMETRY WITH COMPUTER SOFTWARE**

(3 credits) Semester 2 Level 3

Pre-requisite: MATH 2410, MATH2403

Course Content: This course covers the following topics:

- **Introduction:** Curves and arc-length, parameterization of curves, closed curves, level curves, curvature, plane curves, space curves.
- **Global properties of curves:** Simple closed curves, the isoperimetric inequality, the four vertex theorem.
- **Surfaces in three dimensions:** Smooth surfaces, smooth maps, tangent, normals and orientability. Examples of surfaces: level surfaces, quadratic forms, surfaces of revolution, compact surfaces, triply orthogonal systems. The inverse function theorem and its applications.
- **The first and second fundamental forms:** Length of curves on surfaces, isometries of surfaces, conformal mappings of surfaces, equiareal maps and a theorem of Archimedes. The second fundamental form, the Gauss and Weingarten maps, curvature of curves on surfaces, normal and geodesic curvature, parallel transport and covariant derivatives.
- **Lab component:** Representation of surfaces and computation of curvature, torsion, geodesics, etc with computer software.

Evaluation:

- In-course test (1 hour) 20%
- One group project 20%
- Final examination (2 hours) 60%

MATH3405 **NUMBER THEORY**

(3 credits) Semester1 Level 3

Prerequisites: MATH2401, MATH2411

Course Content: This course covers the following topics:

- **Divisors:** Elementary results on divisors, Bezout's Identity, Linear Diophantine Equations
- **Prime Numbers:** Prime-Power Factorizations, Distribution of Primes, Fermat and Mersenne Primes
- **Congruences:** Modular Arithmetic, Linear Congruences, Simultaneous Linear Congruences,
- Simultaneous Nonlinear Congruences, the extended Chinese Remainder Theorem
- C**ongruences with a Prime Power Modulus:** The arithmetic of Z_p, Pseudoprimes and Carmichael Numbers, solving Congruences mod p^n
- **Euler's function:** Units, Euler's Function, Applications of Euler's Function
- **The Group of Units:** The group U_n, Primitive Roots, The group U_n when $n = p^k$ Applications of Primitive Roots

Evaluation:

- Two (1 hour) midterm tests (20% each) 40%
- Final written examination paper (2 hours) 60%

MATH3411 **ADVANCED ABSTRACT ALGEBRA**

(3 Credits) Semester 2 Level 3

Pre-requisite: MATH2411

Course Content: This course covers the following topics:

- **Rings:** Definition of a ring; classification of rings; elementary facts about rings; homomorphisms between rings; ideals and quotient rings; maximal ideals.
- **Special types of rings:** Integral domains; elementary facts about integral domains; Euclidean rings; primes in a Euclidean domain; the g.c.d. in a Euclidean domain; the Euclidean algorithm. The rings ***R****[x]* and ***C****[x]*.
- **Field Theory:** Definition and examples of fields; extension fields, the degree of an extension; roots of polynomials; finite fields.

Evaluation:

- Three written assignments (5% each) 15%
- In-course examination (1 hour) 15%
- One final examination (2 hours) 70%

MATH3412 **ADVANCED LINEAR ALGEBRA**

(3 Credits) Semester 1 Level 3

Pre-requisite: MATH2410

Course Content: This course covers the following topics:

- **Sector Spaces:** Vector spaces over an arbitrary field, subspaces of vector spaces, span and independence, bases and finite dimensional vector spaces, bases and infinite dimensional vector spaces, coordinate vectors.
- **Linear Transformation:** Short introduction to linear transformations, range and kernel, correspondence and isomorphism theorems,

matrix representation, algebra of L(V,W) and $M_{mn}(F)$, invertible transformations and matrices.

- **Theory of linear operators:** invariant subspaces, cyclic operators, maximal operators on real and complex vector spaces.
- **Inner product spaces:** inner product, geometry in inner product spaces, orthonormal sets and the Grahm-Schmidt process, orthogonal complements and projections, dual spaces, adjoints.
- **Linear operators on inner product spaces:** self-adjoint and normal operators, spectral theorems, unitary and orthogonal operators, polar decomposition and singular value decomposition, trace of a linear operator.
- **Bilinear maps and forms:** basic properties, symplectic spaces, quadratic forms and conic sections, Jordan canonical form.

Evaluation:

• Four written assignments (5% each)	20%
• One incourse test	20%
• One Final Examination (2 hours)	60%

MATH3414 **SELECTED TOPICS IN OPERATIONS RESEARCH**

(3 Credits) Semester 1 Level 3

Pre-requisite: MATH2140

Course Content: This course covers the following topics:

- **The Theory of Holding Inventory** - Various inventory models are examined - both deterministic and stochastic
- **Queuing Theory** - Random walk process, The M/M/1/1, M/M/1/N, M/M/n/1, M/M/n/N; Models. Birth and death processes
- **Game Theory** - Two-person zero sum games - Games with and without saddle points. Dominance. The use of linear programming to solve games

- **Decision Theory** - Decision Trees. Maximizing expected return, EVPI and EVSI
- **Replacement Theory** - Optimal time to dispose of fixed assets that depreciate with time

Evaluation:

• Four assignments (5% each)	20%
• One computer-based group project	10%
• Final Examination (2 hours)	70%

MATH3421 **PARTIAL DIFFERENTIAL EQUATIONS**

(3 Credits) Semester 1 Level 3

Pre-requisite: MATH2420

Course Content: This course covers the following topics:

- **Introduction:** Basic concepts and definitions, Strategies for studying PDEs: Well-posed problems, classical solutions, initial and boundary value problems; Typical difficulties;
- **First order PDEs:** Linear and quasi-linear PDEs, Method of characteristics, Nonlinear first-order PDE: Complete Integrals, envelopes, Characteristics, Charpit's and Jacobi's methods, Introduction to conservation laws;
- **Second order linear PDEs:** Classification in the case of constant coefficients, Classification of general second order operators, Linearity and Superposition. D'Alembert solution of the Wave Equation, Propagation of discontinuities;
- **Fundamental properties of elliptic and parabolic equations**: Laplace's equation, Green's theorem and uniqueness for the Laplace's equation, The maximum principle, The heat equation
- **Separation of variables and Fourier series:** The method of separation of variables, Orthogonality, Completeness and the

Parseval’s equation, The Riemann-Lebesgue lemma, Convergence of the trigonometric Fourier series, Uniform convergence, Schwarz's inequality and completeness, The heat equation revisited, Laplace's equation in a rectangle and in a circle, wave equation;

- **Sturm-Liouville theory:** Sturm- Liouville boundary value problems, Eigenvalues and Eigenvectors;
- **Lab**: Solution of partial differential equations with the help of mathematical software package Maple or Matlab;

Evaluation:

- One Final Examination (2 hours) 60%
- Mid Semester Examination 20%
- Four Assignments (5% each) 20%

MATH3422 **MATHEMATICAL MODELLING**

(3 Credits) Semester 1 Level 3

Pre-requisites: MATH2401, MATH2410, MATH2420

Course Content: This course covers the following topics:

- **Introduction to modelling:** Purpose of modelling; Constructing a model – problem statement, formulation, solution, validation; Illustrative examples; Decision-making with mathematical models; Arms race models; Economic models of the effect of taxation.
- **Discrete models:** Discrete-time modelling; Discrete approximation of continuous-time models; Equilibria and long-run behavior; Case studies
- **Continuous Models:** Modeling with a differential equation: Numerical Methods; Solving first order differential equation, generate solution curves and direction fields using mathematical software; case studies in applications to biology and epidemiology etc. Modelling with systems differential equations: modeling; Analysis of system of equations using software; Case studies

- **Lab Component:** Simulating the models using Mathematical software

Evaluation:

- One In-course test (1 hour) 20%
- One group project 20%
- Final Examination (2 hours) 60%

MATH3423 **RESEARCH PROJECT IN MATHEMATICS**

(3 Credits) Semester 2 Level 3

Pre-requisites: MATH 2401, MATH2420, Courses prescribed by the supervisor with the nature of the project.

Course Content:

Project topics will be decided upon by faculty members of the Department of Mathematics, if appropriate with input from students. Topics should reflect the area of expertise of the faculty member who will act as supervisor, the interests of the student, and the objectives of the student's chosen major. Projects may require the theoretical or computational investigation of a mathematical topic, the construction of a model for a real-world phenomenon using skills developed in the course of the students' studies. Reading projects centered on advanced mathematical topics are also acceptable. Ordinarily, the supervisor should be a member of the Department of Mathematics, however if appropriate a co-supervisor from another department may be appointed if successful completion of the project.

Evaluation:

- Written thesis 70%
- Oral examination 30%

The written component will be examined by the project supervisor. The oral component will be examined by a committee consisting of the project supervisor and two appointed internal examiners with an appropriate level of expertise in the subject matter. The format of the oral examination for each group will be as follows: each individual student will give an oral presentation lasting no more than 10 minutes, followed by questions from the examination committee. The oral examination will be chaired one of the appointed internal examiners.

MATH3424 **NUMERICAL METHODS**

(3 Credits) Semester 2 Level 3

Pre-requisites: MATH2401

Course Content: This course covers the following topics:

- **Numerical Linear Algebra**: Matrices, vectors, and scalars; triangular systems; operation counts; the Cholesky decomposition; Gaussian elimination with partial pivoting; Diagonally dominant matrices; the Jacobi method; the Gauss-Seidel method.
- **Nonlinear Equations**: The bisection method; error of approximation with the bisection method; Newton's method; the order of convergence of an algorithm; special computations (such as square roots and reciprocals).
- **Polynomial Interpolation**: Lagrange polynomials; the existence and uniqueness of an interpolating polynomial; the Newton form of the interpolant; the divided differences table; evaluating the interpolating polynomial; errors of approximation.
- **Numerical Integration**: The trapezoid rule; Simpsons rule; the composite Trapezoid and Simpson's rules; errors of approximation; Gaussian quadrature.
- Practical implementation in the computer laboratory.

Evaluation:

• Two lab assignments (10% each)	20%
• One in-course test (1 hour)	20%
• One final examination (2 hours)	60%

MATH3425 **TECHNIQUES FOR SOLVING ADVANCED MATHEMATICS PROBLEMS**

(3 Credits) Semester 1 Level 3

Pre-requisite: MATH2401, MATH2410

Course Content: This course covers the following topics:

- **Euclidean Geometry:** Triangle theorems, similarity as a problem-solving technique; circle theorems, including the chord-angle theorem and theorems on triangles in a circle; problem-solving techniques using parallel lines on a circle.
- **Modular Arithmetic:** The Principle of Induction as a problem-solving technique; advanced uses of the pigeon-hole principle; divisibility; solving problems with congruencies, and solutions of linear congruencies modulo *m*.
- **Algebra:** Sums and differences of squares; non-linear systems of equations; the arithmetic-geometric-harmonic inequality; the Cauchy-Schwartz inequality, using pattern and symmetries in solving inequalities; techniques for finding extrema; isoperimetric problems; polygons inscribed and circumscribed in a circle.

Evaluation:

- Three group presentations (one for each content area, 15% each) 45%
- One written final examination paper (2 hours) 55%

MATH3801 **FINANCIAL MATHEMATICS II**

(3 Credits) Semester 1 Level 3

Pre-requisites: MATH2701, MGMT2023, MGMT3048, MATH2404

Course Content: This course covers the following topics:

- **Bond price Sensitivity -** Review bond valuation. Bond price sensitivity to changes in coupon rate, yield rate, and term to maturity.

- **General Cash flow and Portfolios -** Duration and convexity of a set of cash flows. Spot rates, forward rates, yield curve, bootstrapping.
- **Immunization -** Cash flow matching, immunization, construction of investment portfolios.
- **Introduction to Derivatives -** OTC market, ask/bid price, short selling, short/long position, credit risk, marking-to-market, margin; derivative: call/put option, European/American/Bermudan Option, covered call, naked writing, protective put, put-call-parity. Option Valuation (binomial model, Black-Scholes Model, Risk Neutral model …).

Evaluation:

- One In-course examination (1 hour) 20%
- Two written assignments (5% each) 10%
- Final Examination (2 hours) 70%

<u>MATH3802</u> **<u>EVALUTION ACTUARIAL MODELS</u>**

(3 Credits) Semester 2 Level 3

Pre-requisites: MATH2702, MATH2404, STAT2001

Course Content: This course covers the following topics:

- **Loss Distributions and Reinsurance-**Pareto, Log-normal, Weibull and Burr distributions for modelling claims, Reinsurance arrangements, Reasons for reinsurance, Policy excesses.
- **Individual Risk Models-**Properties of Conditional Expectations, Individual Risk Models, Relative Security Loading, Premiums.
- **Collective Risk Models -** Cumulative generating functions, Properties of Compound distributions, Distribution of Aggregate Claims and approximations therefrom, Poisson Process.
- **Ruin Theory-**Continuous Time Model, Discrete Time Model, Probability of Ruin, Claim Processes, Adjustment Coefficient, Lundberg’s Inequality, Analysis of Reinsurance using Ruin

Theory, First surplus below the initial level, Maximal Aggregate Loss.

Evaluation:

- In-coursework exam worth 15%
- Two written assignments (5% each) 10%
- The final examination (two hours) 75%

MATH3803 **MODELS FOR FINANCIAL ECONOMICS**

(3 Credits) Semester 2 Level 3

Pre-requisite: MATH3801

Course Content: This course covers the following topics:

- **Rational Valuation of Derivative Securities -** European Option Valuation (binomial model, Black-Scholes Model, Risk Neutral model, State Price Vectors …); put-call-parity; Greeks, Explain the properties of a lognormal distribution and explain the Black-Scholes formula as a limited expected value for a lognormal distribution.
- **Simulation -** Simulate lognormal stock prices. Variance reduction techniques for accelerated convergence.
- **Risk Management -** Delta hedging.
- **Hedging and Investment Strategies -** Hedging, arbitrage, hedging strategies.
- **Futures & Forwards -** Forward contract, futures contract, forward price, no-arbitrage (theoretical) price.
- **Swaps -** Simple swap, commodity swap, interest rate swap. Determine no arbitrage (theoretical) value of a swap.

Evaluation:

- One coursework examination (1 hour) 20%
- Two written Assignments (5% each) 10%
- Final Examination (2 hours) 70%

MATH3804 **ACTUARIAL MATHEMATICS II**

(3 Credits) Semester 1 Level 3

Pre-requisites: MATH2701, MATH2702

Course Content: This course covers the following topics:

- **Reserves -** Based on Single Decrement (Life) Table: Calculation of Reserves using Prospective and Retrospective methods, Recursive Formula, Policy Alteration.
- **Joint Life Functions -** Study of T(x) and T (y), the complete future lifetimes of two lives (x) and (y), Joint Cumulative Function, Joint Density Function, Joint survival function, Covariance of T(x) and T (y), Correlation coefficient of T(x) and T(y), Marginal distributions of T(x) and T(y).
- **Study of the Joint Status (xy) and Last Survivor -** Definition of joint status ($x\,y$) and Last Status Survivor $\left(\overline{xy}\right)$, Full study of T ($x\ \ y$) including and T $\left(\overline{xy}\right)$, Cumulative Distribution Function, Probability Density Function, Expectation, Variance, Survival Function, Probabilities associated with T(xy) and T $\left(\overline{xy}\right)$, Force of failure of the status (xy) and status $\left(\overline{xy}\right)$.
- **Insurances and Annuities -** Problems on Insurances and Annuities based on Joint Life status and Last survivor status, Problems on Reversionary Annuities.
- **The Common Shock Model-** Definitions, Modelling Dependence, Applications to all types of Insurance and Annuity Problems.
- **MDT and ASDT-** Definitions, Complete study of MDT, Complete study of ASDT, Construction of MDT from ASDT and vice versa, Incorporating continuous and discrete decrements, Problems involving MDT and ASDT, Applications to Pensions Annuities and Insurances.

Evaluation:

- Coursework Examination (1 hour) 15%
- Final Examination (2 hours) 75%
- Two assignments 10%

MATH 3805 **MATHEMATICS OF PENSION FUNDS**

(3 Credits) Semester 2 Level 3

Pre-requisites: MATH2701, MATH2702, MATH3804

Course Content: This course covers the following topics:

- **General Points about a Pension Plan -** Definition of Pension, Possible sources of Pension, Need for a Pension, Approved Pension Plan, Non Approved Pension Plan, Government's Role, Taxation/Contributions, Investment Income, Types of Pension Plans, Trust Deed and Roles, Administration Contract, Investment Contract, Investment Policy, Risks affecting Pension Benefits, Role of employer, Design Issues, Usual Benefits, Retirement Ages, Options at Retirement, Replacement Ratio, Quality of a Pension Regulatory Agencies.
- **Actuarial Basis for Actuarial Valuation -** Purpose of Valuation, Demographic Basis, Financial/Economic Basis. **Cost Methods (I) -** Individual Cost Methods.
- **Cost Methods (II) -** Aggregate Cost Methods.

Evaluation:

- One coursework examination (1 hour) 20%
- Two written assignments (5% each) 10%
- Final Examination (2 hours) 70%

MATH 3806 **TOPICS IN GENERAL INSURANCE**

(3 Credits) Semester 2 Level 3

Pre-requisites: MATH2701, MATH2404

Course Content: This course covers the following topics:

- **Ratemaking -** Premiums, Exposure, Losand Loss Adjustment Expenses, Underwriting

Expense Provisions, Pure Premium Method, Loss Ratio Method, Final Rate Change.

- **Estimating Claims Liabilities -** Claim Development Triangles, Unpaid Claims Estimates-Development technique, including case outstanding technique, Expected claim technique, Bornhuetter-Ferguson technique, Cape Cod technique, Frequency-Severity techniques, Effect of operating changes, Unpaid claim adjustment expenses.
- **Solvency Issues -** Discuss the historic development of solvency regulation; describe current programs used to monitor solvency; Catastrophe Modelling.

Evaluation:

• One coursework exam	20%
• Two written assignments (5% each)	10%
• The final examination (2 hours)	70%

STAT3001 **REGRESSION ANALYSIS**

(3 Credits) Semester 1 Level 3

Pre-requisites: STAT2001, MATH2410

Course Content: This course covers the following topics:

- **Introduction:** Recap of the following distributions, χ^2, t and F. Expectation, variance and covariance of linear functions; Correlation and hypothesis testing of r; Principles of least squares.
- **Simple Linear Regression:** Basic underlying assumptions; Notations and Model fitting by least squares; Statistical properties of least square estimators:- expectation, variance, covariance; Estimation of σ^2; Partitioning the variability of the response; Inferences:- hypothesis testing, confidence interval and prediction interval; Coefficient of determination; ANOVA and F-test for simple linear regression model; Gauss Markov Theorem(BLUE); Computer outputs (SPSS, R,

Minitab); Lack of fit; Regression through the origin.

- **Residual Analysis -** Residual plots, Model Assumptions (constant variance, independence, normality), outlying and influential observations.
- **Multiple Regression:** Recap of matrix algebra; Model fitting by least squares; Statistical properties of least square estimators: expectation, dispersion matrix and linear combination; Inferences:– hypothesis testing and confidence interval, ANOVA, F-test for the overall model; Extra sums squares principles; Interactions; Dummy variables; Simultaneous Confidence Interval.
- **Model Building Criteria:** R^2, adjusted R^2, S and Mallow's statistic.
- **Selection:** stepwise regression, forward and backward selection.
- **Diagnostics:** leverage value, Cook's distance measure.
- **Assumptions violation remedies:** transformation, weighted least squares.
- **Multi-collinearity:** correlation coefficient between $x's$, effects on least squares estimates, variance inflator factor (VIF).

Evaluation:

• Mini-project	20%
• Problem Papers/Lab Assignments	10%
• Mid-term examination (1 hour)	10%
• Final Examination (2 hours)	60%

<u>STAT3002</u> **<u>TIME SERIES</u>**

(3 Credits) Semester 2 Level 3

Pre-requisites: MATH2404, STAT2001

Course Content: This course covers the following topics:

- **Introduction:** definition, notation and objectives of time series analysis; types of series; simple models and descriptive techniques:-additive, multiplicative models, trend, seasonality, cycles, noise, fits; test for randomness; *describing serial* *dependence:*-autocorrelation coefficients, sample correlation function and correlogram; *describing seasonality:*- seasonal adjustment; *describing trend(smoothing):*- filters and moving averages, differencing, Slutzky-Yule effect, exponential smoothing and other methods; Operators.

- **Stationary Processes:** strict and second-order stationarity (mean, variance, covariance); autocorrelation function, autocovariance and autocorrelation functions, partial autocorrelation function and general linear process.
- **Models for time series:** definitions and properties of the following:- MA:-correlogram, generating functions, invertibility AR:-linear difference equations, characteristic equation, stationarity, Yule-Walker and Wold equations, correlogram ARMA:-stationarity, invertibility, correlogram, extension to integrated processes.ARIMA:-difference equation, general linear process, inverted form, $E(Y \text{ at time } t+k \mid \text{knowledge up to time } t)$

  Model Building: Model identification: differencing to produce stationarity, estimating the correlogram:-sampling properties of sample autocorrelation coefficients; partial autocorrelation coefficients, estimating the partial correlation function. Model fitting: estimation of paramters: - method of moments, least squares, maximum likelihood; fitted values, residuals Model diagnostics: residuals analysis, principle of parsimony, AIC, BIC.
- **Forecasting:** Forecasting under fitted ARIMA models, Box-Jenkins forecasting.
- **Financial time series:** features of financial time series, ARCH (1) model.

Evaluation:

- Mid-term Examination (1 hour) 15%
- Problem papers/lab assignments 25%
- Final Examination (2 hours) 60%

STAT3003 **DESIGN & ANALYSIS OF EXPERIMENTS**

(3 Credits) Semester 2 Level 3

Pre-requisites: STAT2001

Course Content: This course covers the following topics:

- **Introduction:** Collecting data by experiment, Principles of experimental design, Simple design ideas, quick look at ANOVA
- **Background Theory:** Models, matrix formulation, GLM's, parameter estimation, contrasts inference, subdivision of TSS, Cochran's theorem, and parameterisations
- **Completely Randomised Designs:** Fixed and Random effects model, residual analysis, contrasts, quantitative factors by polynomial regression and Tukey's test
- **Randomised Block Designs:** Fixed, Random and Mixed models, randomised block designs, Efficiency, additivity, interaction, missing values, balanced incomplete block, Latin Squares, Graeco-Latin squares, Youden square, Transformation, analysis of covariance
- **Multifactor Experiment:** Factorial treatment structure, nested models, 2^k and 3^k experiments, confounding, partial confounding, fractional replication in 2^k experiments

Evaluation:

• Mid-term Examination (1 Hour)	15%
• Problem Papers (about 4)	10%
• A Written Project	15%
• Final Examination (2 Hours)	60%

Department

OF

Physics

<u>BSc.</u>
Physics with Education

<u>MAJORS</u>
Electronics
Energy and Environmental Physics
General Physics
Materials Science
Medical Physics

<u>MINORS</u>
Electronics
Energy and Environmental Physics
General Physics
Materials Science
Medical Physics

UNDERGRADAUATE COURSES OFFERED BY THE PHYSICS DEPARTMENT						
LEVEL	**CODES**	**TITLES**	**PRE-REQUISITES**	**CO-REQUISITES** **can be done prior to the course*	**SEMESTER**	**CREDITS**
0	**PHYS0411**	**Introduction to Mechanics**	CXC Physics OR CSEC Physics OR GCE O-Level Physics		1	3-P
0	**PHYS0412**	**Introduction to Oscillations & Heat**			1	3-P
0	**PHYS0421**	**Introduction to Electricity & Magnetism**			2	3-P
0	**PHYS0422**	**Introduction to Nuclear Physics & Optics**			2	3-P
1	**ELET1400**	**Introduction to Electronics**	CAPE Physics (Units I & II) OR GCE A-Level Physics OR PHYS0411, PHYS0412, PHYS0421, PHYS0422 OR CXC Physics/CSEC Physics/GCE O-Level Physics and CAPE Mathematics (Units I & II)/GCE A-Level Mathematics/MATH0100, MATH0110		2	3
1	**ELET1405**	**Practices in Basic Electronics**		ELET1400	2	3
1	**PHYS1411**	**Mechanics**			1	3
1	**PHYS1412**	**Waves, Optics & Thermodynamics**			1	3

1	**PHYS1421**	**Electricity & Magnetism**			2	3
1	**PHYS1422**	**Modern Physics**			2	3
2	**ELET2405**	**Practices in Electronics Design I**	ELET1400, ELET1405	Level 2 Electronics or Electronics Engineering course	1	3
2	**ELET2410**	**Analysis and Design of Analog Circuits**	ELET1400, PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		2	3
2	**ELET2415**	**Practices in Electronics Design II**	ELET1400, ELET1405	Level 2 Electronics or Electronics Engineering course	2	3
2	**ELET2420**	**Semiconductor Devices**	ELET1400, PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		2	3
2	**ELET2430**	**Digital Circuits & Microprocessors**	ELET1400, PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		1	3

2	**ELET2450**	**Embedded Systems**	ELET1400, PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		1	3
2	**ELET2460**	**Signals & Systems**	ELET1400, PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		1	3
2	**ELET2470**	**Electric Circuit Analysis**	ELET1400, PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		1	3
2	**ELET2480**	**Communication Systems**	ELET1400, PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		2	3
2	**PHYS2200**	**Practices in Medical Physics 1**	PHYS1411, PHYS1412, PHYS1421, PHYS1422	PHYS2296	2	3
2	**PHYS2296**	**Physics of the Human Body**	PHYS1411, PHYS1412, PHYS1421, PHYS1422		2	3
2	**PHYS2300**	**General Physics Lab I**	PHYS1411, PHYS1412, PHYS1421, PHYS1422	PHYS2351, PHYS2386	1	3
2	**PHYS2351**	**Quantum Mechanics and Nuclear Physics**	PHYS1411, PHYS1412, PHYS1421, PHYS1422	MATH1185	1	3
2	**PHYS2386**	**Electromagnetism & Optics**	PHYS1411, PHYS1412, PHYS1421, PHYS1422		1	3

2	**PHYS2396**	**Computer Applications in Physics**	PHYS1411, PHYS1412, PHYS1421, PHYS1422		1 and 2	3
2	**PHYS2500**	**Materials Science Lab I**	PHYS1411, PHYS1412, PHYS1421, PHYS1422	PHYS2561	2	3
2	**PHYS2561**	**Fundamentals of Materials Science**	PHYS1411, PHYS1412, PHYS1421, PHYS1422, GCE A-Level Chemistry/CAPE Chemistry (Units I & II)/CHEM0901, CHEM0902		2	3
2	**PHYS2600**	**Fluid Dynamics and Environmental Physics Lab**	PHYS1411, PHYS1412, PHYS1421, PHYS1422	PHYS2671	2	3
2	**PHYS2671**	**Fluid Dynamics**	PHYS1411, PHYS1412, PHYS1421, PHYS1422		1 and 2	3
3	**ELET3405**	**Practical Analysis of Advanced Electronic Circuits and Systems**	ELET2405, ELET2415		1	3
3	**ELET3430**	**Instrumentation and Measurements**	ELET2410, ELET2430		1	3
3	**ELET3440**	**Introduction to Robotics**	ELET2430, ELET2450		2	3

3	**ELET3450**	**Satellite Communication & Global Navigation Satellite Systems**	ELET2480		2	3
3	**ELET3460**	**Digital Signal and Image Processing**	ELET2460		2	3
3	**ELET3470**	**Wave Transmission & Fibre Optics**	ELET2480		1	3
3	**ELET3480**	**Wireless Communication Systems**	ELET2480		1	3
3	**ELET3490**	**Electronics Research Project**	ELET2410 OR ELET2450		1 and 2	4
3	**ELET3600**	**Energy Systems Laboratory**	PHYS3671, PHYS3681	ELET3611	1	3
3	**ELET3611**	**Integrating Alternative Energy**	ELET2420	PHYS3671, PHYS3681	2	3
3	**PHYS3200**	**Advanced General Physics Lab**	PHYS2300	PHYS3351, PHYS3386	2	3
3	**PHYS3300**	**Advanced Practices in Medical Physics**	PHYS2200		1	3

3	**PHYS3341**	**Biomedical Optics and Biomechanics**	PHYS2296		1	3
3	**PHYS3351**	**Modern Physics 2**	PHYS2351		2	3
3	**PHYS3386**	**Electromagnetism**	ELET2480 OR PHYS2386		1 and 2	3
3	**PHYS3389**	**Medical Radiation Physics & Imaging**	PHYS2296		2	3
3	**PHYS3395**	**Astronomy & Cosmology**	PHYS1411, PHYS1412, PHYS1421, PHYS1422		2	3
3	**PHYS3399**	**Research Project (Non-Electronics)**	Head of Department's Permission		1 and 2	4
3	**PHYS3500**	**Advanced Materials Science Laboratory**	PHYS2500		1	3
3	**PHYS3561**	**The Physics of Crystalline Materials**	PHYS2561		2	3
3	**PHYS3562**	**The Physics of Non-Crystalline and Amorphous Materials**	PHYS2561		1	3
3	**PHYS3565**	**Thermodynamics and Kinetics of Materials**	PHYS2561		2	3

3	**PHYS3661**	**Physics of the Atmosphere & Climate**	PHYS1411, PHYS1412, PHYS1421, PHYS1422		2	3
3	**PHYS3671**	**Solar Power**	PHYS3661		1	3
3	**PHYS3681**	**Wind & Hydro Power**	PHYS2671, PHYS3661		2	3
1	**MATH1141**	**Introduction to Linear Algebra & Analytic Geometry**	GCE A-Level Mathematics OR CAPE Mathematics (Units I & II) OR MATH0100, MATH0110		1	3
1	**MATH1185**	**Mathematics for Scientists & Engineers**			1	3
2	**MATH2230**	**Engineering Mathematics II**	MATH1185, MATH1141		1	3

Students pursuing a major in Physics Department are required to complete *MATH1185- Calculus for Scientists & Engineers and MATH1141- Intro to Linear Algebra and Analytic Geometry* before their final year.

To qualify for Level 2 Physics students must have: PHYS1411 – Mechanics; PHYS1412 – Waves, Optics & Thermodynamics; PHYS1421 – Electricity & Magnetism; PHYS1422 –Modern Physics; ELET1400 (except Material Science major); Electronics major needs ELET1405.

A **double major** in the Physics Department must have Electronics as one of the majors.

REQUIREMENTS FOR MAJORS AND MINORS				
	Major *requires 36 Level 2 Credits as outlined below*		**Minor** *requires 18 Level 2 Credits as outlined below*	
	Core	**Electives**	**Core**	**Electives**
General Physics	PHYS2351 PHYS2386 PHYS2396 PHYS2300 ELET2420 MATH2230 PHYS3200 PHYS3351 PHYS3386 PHYS3396	PHYS3399 Any other level 2/3 PHYS course Any level 2/3 Electronics	PHYS2351 PHYS2386 PHYS2396 PHYS3351 PHYS3386	PHYS3399 Any other level 2/3 PHYS course Any level 2/3 ELET Course
Energy and Environmental Physics	ELET3611 PHYS2300 PHYS2351 PHYS2386 PHYS2396 PHYS2600 PHYS2671 ELET3600 PHYS3661 PHYS3671 PHYS3681 ELET2420		PHYS2300 PHYS2351 PHYS2386 PHYS2396 PHYS2600 PHYS3661 PHYS3671	-

Medical Physics	ELET2460 PHYS2200 PHYS2296 PHYS2351 PHYS2386 PHYS2396 PHYS2300 PHYS3300 PHYS3341 PHYS3398	**Any one of the following** MATH2230 PHYS3399 Any other level 2/3 PHYS Course Any level 2/3 Electronics	PHYS2200 PHYS2351 PHYS2386 PHYS2396 PHYS2296 PHYS3390	-
Materials Science	PHYS2351 PHYS2386 PHYS2396 PHYS2300 PHYS2561 PHYS2500 PHYS2671 PHYS3561 PHYS3562 PHYS3565 PHYS3500	**Any one of the following** Math 2230, PHYS 3399 Any other level 2/3 PHYS Course Any level 2/3 Electronics	PHYS2300 PHYS2351 PHYS2386 PHYS2500 PHYS2561 PHYS3561 PHYS3562	-
Electronics	ELET2405 ELET2415 ELET2470 ELET2430 ELET2410 ELET3405 ELET3490	*Any four of the following - at least two must be from Level 3* ELET2460 ELET2480 ELET2450 ELET3450 ELET3480 ELET3470 ELET3460 ELET3412 ELET3485	ELET2405 ELET2415 ELET2470 ELET2430 ELET2410	Any other level 2/3 ELET course

Requirements for a Major in the Physics Department

The table below outlines the courses required for a **major** in the Department of Physics. Please note that in some cases additional credits must be obtained from other Physics Department courses to satisfy the **36 credits** needed for the major. Other department and/or Faculty and/or out of Faculty courses (including Foundation courses) must be done to satisfy the **101 credits necessary for award of your degree**.

A **double major** within the department is possible **only if the Electronics major** is a part of the double major. E.g. A major in Electronics and a major in General Physics. Also **a major and a minor** within the department is possible **only if Electronics** satisfies the **major or the minor**. E.g. A major in Medical Physics with a minor in Electronics. Alternatively double majors may be done with **any Physics Department major** and **a major from another Department** e.g. A major in Material Science with a major in Chemistry.

MAJORS	**YEAR 1**		**YEAR 2**		**YEAR 3**		**ELECTIVES**
	SEMESTER 1	**SEMESTER 2**	**SEMESTER 1**	**SEMESTER 2**	**SEMESTER 1**	**SEMESTER 2**	
GENERAL PHYSICS	**MATH1141** **MATH1185** **PHYS1411** **PHYS1412**	**ELET 1400** **PHYS1421** **PHYS1422**	**PHYS2300** **PHYS2351** **PHYS2386**	ELET2420	MATH2230 **PHYS3386**	**PHYS2396** PHYS3100 **PHYS3351**	Any 3 of the following PHYS3399 PHYS3565 (highly recommended) Level 2 or 3 PHYS course Level 2 or 3 ELET course
ENERGY AND ENVIRONMENTAL PHYSICS	**MATH1141** **MATH1185** **PHYS1411** **PHYS1412**	**ELET 1400** **PHYS1421** **PHYS1422**	**PHYS2300** **PHYS2351** PHYS2671	ELET2420 **PHYS2600** **PHYS3661**	ELET3600 **PHYS2386** **PHYS3671**	ELET3611 **PHYS2396** PHYS3681	
MEDICAL PHYSICS	**MATH1141** **MATH1185** **PHYS1411** **PHYS1412**	**ELET 1400** **PHYS1421** **PHYS1422**	ELET2460 **PHYS2300** **PHYS2351** **PHYS2386**	**PHYS2200** **PHYS2296** PHYS2396	PHYS3300 PHYS3341	**PHYS3398**	Any 2 of the following MATH2230 PHYS3399 Level 2 or 3 PHYS course Level 2 or 3 ELET course
MATERIALS SCIENCE	**MATH1141** **MATH1185**	**PHYS1421** **PHYS1422**	**PHYS2300** **PHYS2351**	**PHYS2500** **PHYS2561**	PHYS3500 **PHYS3562**	PHYS2396 **PHYS3561**	Any 1 of the following MATH2230
	PHYS1411		**PHYS2386**	PHYS2671		PHYS3565	PHYS3399

	PHYS1412						Level 2 or 3 PHYS course Level 2 or 3 ELET course
ELECTRONICS	**MATH1141** **MATH1185** **PHYS1411** **PHYS1412**	**ELET 1400** **ELET1405** **PHYS1421** **PHYS1422**	**ELET2405** **ELET2430** **ELET2470**	**ELET2410** **ELET2415**	ELET3405	ELET3490	Any 5 of the following Level 2 or 3 ELET course
There are two streams that some electronics students choose to "specialise" in. These are Telecommunications and Robotics & Instrumentation. There are some courses that need to be done in any of these streams and they are listed below. Please note that these are suggestions and are not meant to restrict your choice of courses or course combinations.							
<u>TELECOMMUNICATIONS</u>	**MATH1141** **MATH1185** **PHYS1411** **PHYS1412**	**ELET 1400** **ELET1405** **PHYS1421** **PHYS1422**	**ELET2405** **ELET2430** ELET2450 ELET2460	**ELET2410** **ELET2415** ELET2480	**ELET2470** ELET3405 ELET3470 ELET3480	ELET3450 ELET3460 ELET3490	
<u>ROBOTICS AND INSTRUMENTATION</u>	**MATH1141** **MATH1185** **PHYS1411** **PHYS1412**	**ELET 1400** **ELET1405** **PHYS1421** **PHYS1422**	**ELET2405** **ELET2430** ELET2450 ELET2460	**ELET2410** **ELET2415** ELET2480	**ELET2470** ELET3405 ELET3430 ELET3480	ELET3440 ELET3490	

Courses in **bold** are required for a minor.

A major in Physics/Electronics requires 36 credits of advanced level (level 2 and level 3) courses.

A minor in Physics/Electronics requires 18 credits of advanced level (level 2 and level 3) courses.

<u>Additional Physics/Electronics courses may be needed to complete a major.</u>

If pursuing a double major, a single advanced level course CANNOT count towards 2 majors. Therefore, due to overlapping core courses, a double major within the department MUST haveElectronics as one of the majors. Note well, ELET2420 is a core course for almost all non-electronics major, so it cannot be counted towards the Electronics major as a free elective.

The Mathematics courses listed are those required to complete Physics majors. For more information on Mathematics courses, please contact the Department on Mathematics. Students pursuing both MATH1142 and MATH1151 otherwise do not need to do MATH1185.

Notes:

- *Other credits are required to complete majors. See previous page. Electives can be selected in any semester of Level 2 and Level 3 as offered.*
- *Other credits are required to complete the degree.*
- *MATH1141and MATH1185 are compulsory and recommended for completion in Level 1, but may be done in Level 2.*
- *Preliminary Chemistry courses or their equivalent are needed for Materials Science Major (NB. Preliminary Chemistry or equivalent needed).*

BSc. PHYSICS WITH EDUCATION

LEVEL 1

Twenty-four (24) credits from two subject areas in the Faculty of Science and technology, divided equally between the two so as to provide the Pre-requisites for Level 2 courses (Note that MATH1141 & MATH1185 must be completed prior to pursing Level 3 Physics Department courses). One of the subject areas must be Physics (required courses are PHYS1411, PHYS1412, and PHYS1421 & PHYS1422). Foundations of Education courses (see A below) may also be taken with Level 1 courses from the Faculty of Science and Technology.

Trained Teachers with the New Double Option (since 2004) with Physics as one of their majors and who have a GPA of at least 2.9 may be granted exemption from Level 1 requirements.

Trained Teachers with Single Option science are required to do Preliminary Physics.

LEVEL 2

Thirty-three (33) Credits from Level 2 Physics courses such that they constitute one of the Physics Majors being offered: General Physics, Energy and Environmental Physics, Medical Physics, Materials Science.

EDUCATION COURSES

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

COURSE DESCRIPTION

PHYS0411 **INTRODUCTION TO MECHANICS**

(3 P-Credits) Semester 1 Level 0

Pre-requisite: CXC/CSEC Physics or GCE "O" Level Physics

Course Content: This is a pre-calculus course covering fundamental of Mechanics.

Physical Quantities and Units

- Physical quantities and their units with mass, length, time and temperature as fundamental (base) quantities. The nature of the physical quantities: scalars and vectors, components of a vector, addition and subtraction of vectors by means of components;

K**inematics in One Dimension**

- Definitions in displacement, speed (average and instantaneous), velocity (average and instantaneous), acceleration (average and instantaneous). Displacement-time and velocity-time graphs. Graphical interpretation of velocity and acceleration. Distance travelled as area under the velocity-time graph. Derivation of kinematic equations for constant acceleration and their application to solving problems;

Projectile Motion

- Introduction to projectile motion as a combination of two one-dimensional motions. Derivative of range, maximum height and time of flight. Derivation of the equation for a parabolic path. Application of the equations for projectile motion. Forces & Newton's Laws of Motions; Concepts of force, mass and inertia. Statement of Newton's Laws. Vector nature of Newton's Second Law of Motion ($\Sigma F_x = ma_x$,$\Sigma F_y = ma_y$);

Types of Forces

- Static and kinetic frictional forces. Tension. Gravitational forces. Newton's laws of gravitation. Moment of a force. Equilibrium and conditions for equilibrium. Forces on an object immersed in a fluid. Pressure and upthrust. Archimedes' principle and its derivation using a cubical object. Simple battery hydrometer. Viscosity. Statement of Stokes' law and the concept of terminal velocity;

Dynamics of Uniform Circular Motion

- Introduction to the concept of centripetal acceleration and force. Centripetal force and motion around a curve. Satellites in circular orbits;

Work and Energy

- Concepts of work and power. Kinetic and potential energies. Work-Energy Theorem. Definition of conservation of force. The principle of conservation of mechanical energy. Concepts of energy conversion and applications with special references to renewable energy sources such as solar, wind, geothermal and wave;

Impulse and Momentum

- Definition of impulse and linear momentum. Impulse-Momentum theorem. The principle of conservation of linear momentum including the derivation using the impulse-momentum theorem. Application to collisions;

Evaluation:

- One 2-hour theory examination 60%
- One 1-hour in-course test 15%
- Tutorial tests 15%
- Laboratory work 10%

PHYS0412 **INTRODUCTION TO OSCILLATIONS AND HEAT**

(3 P-Credits) Semester 1 Level 0

Pre-requisite: CXC/CSEC Physics or GCE “O” Level Physics

Course Content: This is a pre-calculus course covering fundamental topics in Oscillations and Heat.

- **Simple Harmonic Motion:** Introduction to Hooke's Law and definition of simple harmonic motion. Treatment of light spring-mass system as simple harmonic oscillator. The displacement-time graph for SHM and the application of x =A cos(w t) or x =A sin(w t) to interpret the results. Expressions for velocity, acceleration and period for SHM. Energy considerations and conservation for SHM. The Simple Pendulum.

- **Temperature and Thermometers:** Thermal equilibrium and the Zeroth law of thermodynamics. Thermal expansion. The Gas laws and absolute temperature. The ideal gas law. The ideal gas law in terms of molecules. Avogadro's number. Kinetic theory. Real gases and change of phase. Vapour pressure and humidity.
- **Heat and internal energy.** Specific heat capacity. Latent heat. Calorimetry. Heat transfer: Conductio**n, convection and radiation. F**irst law of thermodynamics. First law applied to simple processes including isobaric and isothermal processes.

Evaluation:

- One 2-hour theory examination 60%
- One 1-hour in-course test 15%
- Tutorial tests 15%
- Laboratory work 10%

PHYS0421 **INTRODUCTION TO ELECTRICITY AND MAGNETISM**

(3 P-Credits) Semester 2 Level 0

Pre-requisite: CXC/CSEC Physics or GCE “O” Level Physics

Course Content: This is a pre-calculus course covering two main areas of Physics that are very closely related.

- **Electric field and potential:** Definition of point charge. Coulomb’s law; The electric field E; Force on a charge q in electric field E; Electric potential; Charge q traversing electric potential ΔV; Definition of the electron volt; Electric potential energy; Charge q in a conducting sphere; Resulting E and V; **Capacitors**: Q = CV;

Capacitance of the parallel plate capacitor and the electric field between charged plates; Dielectrics; Energy stored in a charged capacitor and energy density in terms of E; Capacitors in series and parallel;

- **Ohm's Law:** Resistors in series and parallel; Emf, internal resistance and terminal potential difference of a battery; Kirchhoff's laws and applications; Electric power for DC and AC voltages;
- **Magnetism:** Force on current-carrying wire in a magnetic field; Definition of magnetic field B; Force due to B on charge q moving with velocity v; B due to a long straight current-carrying wire and a solenoid; Force between current-carrying conductors; Definition of the Coulomb and Ampere;
- **Electromagnetic Induction:** Faraday's law of electromagnetic induction; Lenz's law; Motional emf; The inductance L; Energy stored in an inductor and energy density in terms of B; Electric generators;

- **Logic Gates and their truth tables.** P-type and n-type semiconductors; Diodes;

Evaluation:

• One 2-hour theory examination	60%
• One 1-hour in-course test	15%
• Tutorial tests	15%
• Laboratory work	10%

PHYS0422 **INTRODUCTION TO NUCLEAR PHYSICS AND OPTICS**

(3 P-Credits) Semester 2 Level 0

Pre-requisite: CXC/CSEC Physics or GCE "O" Level Physics

Course Content: This is a pre-calculus course covering fundamental topics in Nuclear Physics and Optics.

Optics

- **Light as Electromagnetic Wave:** The electromagnetic spectrum; The speed of light; Wavefronts and rays; Laws of reflection; Image formation by Concave and convex mirrors; Refraction of light; Index of refraction; Snell's law; Total internal reflection and the critical angle; Examples of application of TIR;
- **Lenses:** Thin converging and diverging lenses; Image formation by lenses using ray diagrams; Linear magnification; Derivation of the lens equation and sign convention; Lenses in combination;
- **Human Eye:** Anatomy of the human eye; Image formation by the eye of objects at varying distances; Defects of vision (nearsightedness and farsightedness) and their correction by lenses;
- **Telescopes and Microscopes:** Angular magnification; Simple and compound microscopes and their angular magnification; Astronomical and Galilean telescopes and angular magnification;

Nuclear Physics

- **Nuclear Model of the Atom:** Geiger-Marsden experiment; Nuclear structure; The fundamental forces; Binding energy and mass defect; Atomic mass unit; Nuclear stability and natural radioactivity; Fission and fusion;
- **Radioactivity:** Radioactive decay and its equation; Activity; Radioactive dating; Medical and other applications of radioactivity; X-ray production and spectrum; Simple radioactive detectors;

Evaluation:

- One 2-hour theory examination 60%
- One 1-hour in-course test 15%
- Tutorial tests 15%
- Laboratory work 10%

PHYS1411 **MECHANICS**

(3 Credits) Semester 1 Level 1

Pre-requisites: CAPE/A-Level Physics or (PHYS0411, PHYS0412, PHYS0421 and PHYS0422) or (CSEC Physics with CAPE/A-Level Maths or MATH0100 and MATH0110)

Course Content: This is a ***calculus-based*** course covering the basic laws and phenomena in Mechanics

Mechanics

Scalars and Vectors

- Scalar and Vector products; Vectors and their components; Unit vectors; Vector algebra in terms of their components;

Vector Treatment of Motion

- Position vector and particle trajectory; Average and instantaneous acceleration; Application to uniform circular motion; Derivation of $a = -w^2r$; Relative velocity;

Work and Kinetic Energy

- General definition of work; Work done by a variable force; One-dimensional analysis; Interpretation of work as area under graph of F vs x; Proof of Work-Kinetic Theorem;

Conservation of Energy

- Conservative Forces; General definition of potential energy and examples of its calculation; Mechanical Energy; Proof of conservation of Mechanical Energy; Non-conservative forces; Conservation of total energy;

System of Particles

- Centre of mass for systems of particles and extended objects; Newton's Second Law for systems of particles and extended objects and consequences; Proof of conservation of linear momentum;

Rotation

- Description of rotation using θ, w and α ; Kinematic equations; Kinematic energy of rotation; Rotational inertia and its calculation for some symmetrical objects; Parallel and

Perpendicular Axes Theorem; Torque $\tau = r \times F$ and $\tau = I w$; Work and Torque;

Rolling

- Definition of Rolling; Rolling as a combination of rotation and translation; Rolling as pure rotation about an instantaneous axis; Role of friction in rolling; Kinetics and dynamics of rolling; Definition of Angular Momentum; Newton's Second Law in angular form; Angular momentum for a system of particles; Conservation of angular momentum and its application;

Simple Harmonic Motion

- Equation of Linear SHM in differential form and solution as $x = A \sin(\omega t + \theta)$; Definition of angular SHM in terms of torque and angular displacement; Differential equation of motion and its solution; Examples such as physical pendulum (and limiting case of simple pendulum) and suspended oscillating disc;

Evaluation:

- One 2-hour theory examination 60%
- One 1-hour in-course test 15%
- Tutorial tests 15%
- Laboratory work 10%

PHYS1412 **WAVES, OPTICS AND THERMODYNAMICS**

(3 Credits) Semester 1 Level 1

Pre-requisites: CAPE/A-Level Physics or (PHYS 0411, PHYS 0412, PHYS 0421 and PHYS 0422) or (CSEC Physics with CAPE/A-Level Maths or MATH0100 and MATH0110)

Course Content: This is a ***calculus-based*** course covering the basic laws and phenomena in Waves, Optics and Thermodynamics:

Waves and Optics

- **Waves on a String**: Transverse and longitudinal waves; The wave equation; Phase velocity; The sine wave; Power transmission; Superposition principle; Interference; Standing waves and Resonance;

- **Sound waves**: Wave speed (without derivation); Displacement and pressure waves; Beats; Doppler effect for sound waves;
- **Optics**: Huygen's Principle (eg; in Refraction); The electromagnetic wave;
- **Coherence**: Young's experiment; Intensity in double slit interference; Thin film interference (including wedge films and Newton's rings);
- **The Phasor Method**: Single slit diffraction; The diffraction grating;
- **Heat and Thermodynamics: Temperature; Heat and the First Law**: Measuring temperature; Constant volume gas thermometer; Ideal gas temperature; Measurement of thermodynamic temperature; Absorption of heat by solids and liquids; Molar specific heat; Heat and Work; Calculation of work done by an ideal gas at constant temperature; Differential form of First Law of Thermodynamics and application to selected cases;
- **Kinetic Theory of Gases**: RMS speed, pressure, translational kinetic energy and pressure; Adiabatic equation of an ideal gas;
- **Entropy and the Second Law**: Entropy and the second law of Thermodynamics; Heat engines and refrigerators;

Evaluation:

- One 2-hour theory examination 60%
- One 1-hour in-course test 15%
- Tutorial tests 15%
- Laboratory work 10%

PHYS1421 **ELECTRICITY AND MAGNETISM**

(3 Credits) Semester 2 Level 1

Pre-requisites: CAPE/A-Level Physics or (PHYS0411, PHYS0412, PHYS0421 and PHYS0422) or (CSEC Physics with CAPE/A-Level Maths or MATH0100and MATH0110)

Course Content: This is a ***calculus-based*** course covering the basic laws and phenomena in Electricity and Magnetism.

Electricity & Magnetism

- **Electric field and potential:** The electric field E due to extended charge distributions; Integral and differential expressions relating the electric potential V to the E field; Potential due to a dipole and other extended charge distributions;
- **Gauss' Law:** Application to problems with spherical, cylindrical and rectangular symmetry;
- **Capacitance:** Calculation of the capacitance of various capacitors; Energy stored in a capacitor; RC circuits; Time constant;
- **Magnetism:** Magnetic force on current-carrying wire and its application to cases needing calculus treatment; Magnetic torque on a current loop; Magnetic moment of a current loop; The Hall-Effect; Biot-Savart Law and Ampere's Law, and their application to long current-carrying wire, loop, and solenoid;
- **Electromagnetic Induction:** Faraday's Law and Lenz's Law; Electro-magnetic induction and its applications; Self Induction; Inductance; RL circuits;
- **Electromagnetic Oscillations and Alternating Currents:** LC Oscillation; Damped oscillation in an RLC circuit; Alternating current; Forced oscillation; RLC circuits; Power in AC circuits; the Transformer; Introduction to the Electromagnetic wave;

Evaluation:

- One 2-hour theory examination 60%
- One 1-hour in-course test 15%
- Tutorial tests 15%
- Laboratory work 10%

PHYS1422 **MODERN PHYSICS**

(3 Credits) Semester 2 Level 1

Pre-requisites: CAPE/A-Level Physics or (PHYS 0411, PHYS 0412, PHYS 0421 and PHYS 0422) or (CSEC Physics with CAPE/A-Level Maths or MATH0100 and MATH0110)

Course Content: This is a ***calculus-based*** course covering the basic laws and phenomena in **Modern Physics.**

Modern Physics

- Bohr Atom: Spectral series for hydrogen, Bohr's postulates, derivation of energy levels, blackbody radiation and quantized energy levels (qualitative);
- Waves and Corpuscles: Wave-particle duality; photo-electric effect; Compton-effect; energy, momentum and wavelength of a photon, deBroglie's equation, wave function, particle in a box;
- Special Relativity: Galilean relativity; Einstein postulates; Lorentz transformation; simultaneity; time dilation; length contraction; derivation of velocity transformations, the equation $E^2 = p^2c^2 + m_o{}^2c^4$ and its applications;
- Particle Physics and the Big Bang: Elementary particles; Three groups; Conservation Laws; Eightfold way; Quarks; Fundamental interactions and their unification; The standard model; The history of the universe;

Evaluation:

- One 2-hour theory examination 60%
- One 1-hour in-course test 15%
- Tutorial tests 15%
- Laboratory work 10%

ELET1400 **PRACTICES IN BASIC ELECTRONICS I**

(3 Credits) Semester 2 Level 1

Pre-requisites: CAPE/A-Level Physics or (PHYS0411, PHYS0412, PHYS0421 and PHYS0422) or (CSEC Physics with

CAPE/A-Level Maths or MATH0100 and MATH0110)

Course Content: This course covers the following topics:

- **Introduction to Semiconductor Theory and the P-N Junction:** Review of the atomic structure and bonding, Conductor, insulator, and semiconductor; Semiconductor materials; Covalent bonded structures in semiconductor; Charge carriers and Energy levels; Energy level diagrams; Intrinsic and Extrinsic semiconductors; Doping; n-type and p-type semiconductors; Drift and Diffusion currents; Resistivity and conductivity; the Fermi Dirac Distribution function; The P-N Junction; P-N junction at Thermal Equilibrium; Junction capacitance; P-N junction diode; Characteristic curve of the p-n junction diode; Forward and reverse biasing; Diode circuits; Zener diodes; Diode data sheets; voltage doubler; Rectification: half wave and full wave; Light emitting diodes (LED); The Bipolar Junction Transistor (BJT); the Field Effect transistor; Biasing the transistor circuit; Transistor as a switch; Relay drivers; Logic gate design with transistors.
- **Introduction to Digital Electronics:** Analog and digital concepts; binary digits and logic levels; digital waveforms; logic gates and truth tables; physical realization of logic gates; Boolean algebra and logic simplification; DeMorgan's theorem; Circuit minimization using Karnaugh maps; Terminologies used in logic designs: Fan in, Fan out, rise time, fall time, propagation delay; debounced switching; Combinational logic circuits:- Decoders, encoders, multiplexers, demultiplexers, parity generators, adders; Number systems, operations and codes; Binary coded Decimal, ASCII, Gray code; Code converters; Lathes, Flip Flops.
- **Introduction to Analog Electronics:** Introduction to alternating current (AC); Frequency dependent resistive (R), capacitive (C) and inductive (L) circuits; Resonance in RLC circuits; Determination of bandwidth and half-power points. First order response in RLC circuits; The Operational Amplifier; Op amp characteristics; Feedback in op amp circuits; The inverting, summing and non-inverting amplifiers; The

differentiator and the integrator; RC filters; First order active filters; Fundamentals of Communication Systems; Amplitude modulation (AM) and demodulation, Frequency modulation (FM) and demodulation, and Digital Communications basic, Basic building block of Transmitters and Receivers.

Evaluation:

- One 2-hour theory examination paper 60%
- Two 1-hour In-course tests (2 × 20%) 40%

ELET1405 **PRACTICES IN BASIC ELECTRONICS II**

(3 Credits) Semester 2 Level 1

Pre-requisites: CAPE/A-Level Physics or (PHYS0411, PHYS0412, PHYS0421 and PHYS0422) or (CSEC Physics with CAPE/A-Level Maths or MATH0100 and MATH0110)

Course Content: This course covers the following topics:

- Week 1: Measuring electronic circuit parameters using oscilloscopes and multimeters;
- Week 2: Determining the characteristics curve of a p-n junction diode and the half wave rectifier;
- Week 3: Evaluating the operation of Full Wave rectifiers and Zener diodes on Voltage regulation;
- Week 4: Investigating Transistor circuits: Logic operation; LED drivers;
- Week 5: Semiconductor circuit design project. (in-class);
- Week 6: Verifying truth tables of logic gates and combinational circuits;
- Week 7: Designing combinational circuit for special applications;
- Week 8: Digital circuit design project (in-class);
- Week 9: Investigating circuit theorems
- Week 10: Investigating Op Amp Circuits;
- Week 11: Investigating AM and FM communication circuits / systems
- Week 12: Analog Circuit Design Project (in-class);

Evaluation:

- Nine Laboratory reports (equal weighting) 15%
- Three design projects (3 x 15%) 45%
- One 2-hour final examination paper 40%

PHYS2200 **PRACTICES IN MEDICAL PHYSICS 1**

(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411; PHYS1412; PHYS1421; PHYS1422

Co-requisite: PHYS 2296

Course Content: The course will consist of six laboratory exercises and a research project. The laboratory exercises are:

- Determination of Young's modulus in bone phantoms;
- Determination of the centre of gravity of a human body;
- Electrocardiogram (ECG) techniques to examine the heart;
- Electromyography (EMG) techniques to examine nerve condition;
- Audiometric analysis of human hearing;
- Optical analysis of human sight;

A research project related to the Level 2 medical physics courses will be assigned. The project content will involve the use of techniques in physics to investigate the effects of a variety of phenomena on the human body (for example, the medical implications of radiation of mobile phones and cell towers).

Evaluation:

- One 2-hour In-course practical examination 30%
- Six laboratory reports of equal weighting 30%
- One written project report (20%) and individual oral presentation (20%) 40%

PHYS2296 **PHYSICS OF THE HUMAN BODY**

(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Course Content: This course covers the following topics:

- Basic anatomy of the human body;
- Terminology, modeling, and measurement;
- Energy, heat, work, and power of the body;
- Muscle and forces;
- Physics of the skeleton;
- Pressure in the body;
- Physics of the lungs and breathing;
- Physics of the cardiovascular system;
- Electrical signals from the body;
- Sound and speech;
- Physics of the ear and hearing;
- Physics of the eyes and vision;
- Human body in space and microgravity;

Evaluation:

- One 2-hour final written examination 60%
- One 1-hour In-course test 20%
- Four graded assignments (equally weighted) 20%

PHYS2300 **GENERAL PHYSICS LAB 1**

(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Co-requisites PHYS 2351, PHYS 2386

Course Content: This course covers the following topics:

- Radioactive decay: Decay and counting statistics for dice;
- Geiger counter and the absorption of gamma rays by matter;
- Wave behaviour of electrons;
- Energy levels in a quantum well;
- Classical and quantum probability;

- Electromagnetism and capacitors;
- Magnetic susceptibility;
- Fresnel diffraction;
- Resolution of spectral lines;
- Fraunhofer diffraction;

Evaluation:

- One 2-hour In-course practical examination 30%
- Ten laboratory reports of equal weighting 20%
- One 4-hour final practical examination 50%

PHYS2351 **QUANTUM MECHANICS AND NUCLEAR PHYSICS**

(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Co-requisite: MATH1185

Course Content: This course covers the following topics:

- **Nuclear Physics:** Basic properties of the nucleus; liquid drop model of the nucleus;α decay & quantum mechanical tunneling; interactions of particles with matter; radiation detectors and magnetic resonance imaging (MRI);
- **Quantum Mechanics:** Limitations of classical physics, operators and eigenfunctions; Schouroedinger's equation and the wave function (ψ); solutions of Schouroedinger's equation for infinite and finite potential wells, step potential barrier & tunneling, and finite square well;

Evaluation:

- Five tutorial assignments (equal weighting) 10%
- Five pop quizzes (equal weighting) 20%
- Two 1-hour In-course tests (equal weighting) 30%
- One 2-hour final written examination 40%

PHYS2386 **ELECTROMAGNETISM AND OPTICS**
(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Course Content: **Electricity and Magnetism:**

- Electric fields and magnetism in matter;
- Displacement current and charge conservation;
- The electromagnetic waves and Maxwell's equations; the plane wave equation; Poynting vector;

Optics:

- Polarization of electromagnetic waves;
- Temporal and spatial coherence;
- Visibility of fringes;
- Diffraction grating;
- Fresnel diffraction and the zone plate;

Evaluation:

- Two 1-hour course tests (each 20%) 40%
- One 2-hour final examination 60%

PHYS2396 **COMPUTER APPLICATIONS IN PHYSICS**
(3 Credits) Semesters 1 & 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Course Content: This course covers the following topics:

- **Introductory Material**
  Introduction to software package (e.g. MATLAB/SciLAB, MathCAD) and programming language (e.g. V-Python); limitations, errors and tolerances;
- **Data organization for manipulation**
  2-D and 3-D plots, matrices and vectors, "Least Squares" method;

- **Functions and Equations**

  Systems of equations and approximation of functions (e.g., Taylor series, Fourier series); differential and state-space equations;

- **Programming**

  Writing //algorithms/programmes (e.g., Bisection method, Newton-Rhapson method); numerical integration;

- **Applications**

  Mandatory: Projectile motion with air resistance; Forced-Damped oscillations; Double-Spring oscillations; the wave equation, the heat equation, Poisson's Equation. Optional Driven damped pendulum; Radioactive Decay; Potentials and Fields; Navier-Stokes Equation; Two- and Three-body problem; Planetary motion; Fourier Analysis; Transients in circuits; Chaos; Molecular dynamics; Electrostatics; Diffusion; Phonons; Random systems; Statistical mechanics; Quantum mechanics;

Evaluation:

- Three graded assignments (PBL) of equal weighting 30%
- Two one-hour practical tests (10% each) 20%
- One 2-hour final practical examination 50%

PHYS2500 **MATERIALS SCIENCE LABORATORY I**

(3 Credits) Semester 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Co-requisite: PHYS2561

Course Content: This course covers the following topics:

- **Determination of the mechanical properties of materials:**

Stress, strain and shear measurements; sound propagation through various materials (acoustic properties); deformation and hardness measurements and comparison to standards; identifying fractures, fatigues and creeps; measuring toughness and impact strength;

- **Investigation of crystalline structures:** Constructing lattice structures; lattice measurements and Miller indices; examining Bragg's law of diffractions and Fick's law of diffusion;
- **Measurement of thermal and electrical properties:** Investigating conduction of electricity and heat; electron-phonon interactions; properties of insulators;

Evaluation:

- Nine laboratory reports of equal weighting 36%
- One paper review (10%) and one oral presentation (14%) 24%
- One 3-hour final practical examination 40%

PHYS2561 **FUNDAMENTALS OF MATERIALS SCIENCE**

(3 Credits) Semester 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422, CHEM0901 and CHEM0902 or equivalent

Course Content: This course covers the following topics:

- **Atomic Structure and Bonding**: Electrons in atoms; types of bonding, melting point;
- **Crystalline and Non-Crystalline (Amorphous) Structures:** Lattice, sub-lattices and lattice parameters; structures: metal, ceramic and covalent; defects and dislocations;
- **Diffusion**: Diffusion mechanisms; Steady-state diffusion (Fick's 1st law); Transient/non-steady state diffusion (Fick's 2nd law), Arrhenius behaviour;

- **Electrical Properties** :Conductivity and mobility; electronic and ionic conduction; electron-phonon interaction in metals; superconductivity, semiconductivity; band theory;
- **Thermal Properties**: Phonons, heat capacity and the Einstein solid; thermal expansion and thermal conductivity;
- **Mechanical Properties**: Stresses, strain, and shear; elastic properties; sound propagation; deformation and hardness; fracture, fatigue, and creep;

Evaluation:

- One 2-hour final written examination 50%
- One graded assignment 15%
- Five graded tutorials (equally weighted) 15%
- One 1-hour In-course test 20%

PHYS2600 **FLUID DYNAMICS & ENVIRONMENTAL PHYSICS LABORATORY**

(3 Credits) Semester 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Co-requisites: PHYS 2671

Course Content: This course covers the following topics:

- Measurement of fluid drag on spheres and disks;
- Investigation of Bernoulli and Poiseulle equations with applications to fluid flow ;
- Energy Losses in fluid flow;
- Computer simulations of fluid flow in circular and rectangular pipes;
- Estimation of evaporation from wet surfaces;
- Investigation of heat flux and latent heat flux;
- Measurement of meteorological parameters;
- Computer aided environmental data analysis;

- Investigation of cloud droplet formation via super cooling of water;
- Simulation of the effects of environmental parameters on climate change;

Evaluation:

• One paper review	10%
• One oral presentation	14%
• Nine laboratory reports	36%
• One 4-hour final practical Examination	40%

PHYS2671 **FLUID DYNAMICS**

(3 Credits) Semesters 1& 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422,

Course Content: This course covers the following topics:

- **Introduction to Mathematical Concepts in Fluid Dynamics**: Vector analysis and basic mathematical tools; physical characteristics of the fluid state and description of flow types; viscosity coefficients as they relate to laminar and turbulent flows; the Poiseuille equation;
- **Kinematics and Dynamics of Fluid Motion**: In-compressible and compressible fluids; Euler's equations of motion; Bernoulli's equation and its application; continuity equation; analyses of steady fluid flow, propeller, wind turbine, and wind velocity profile; Navier-Stokes equation and descriptions of boundary layer and turbulence; vertical transport of kinetic energy, mass, heat, moisture and pollutants;
- **Introduction to Atmospheric flows**:Apparent forces (Coriolis and centrifugal) in rotating coordinate systems and their effects; geostrophic flows; qualitative introduction to Ekman layer; basic treatment of Rossby waves and Kelvin waves;

Evaluation:

- Two 1-hour In-course tests (equal weighting) 40%
- One 2-hour final written examination 60%

ELET2405 **PRACTICES IN ELECTRONICS DESIGNS I**

(3 Credits) Semester 1 Level 2

Pre-requisites ELET1400 and ELET1405

Co-Requisite: Any level 2 Semester 1 Electronics or Electronics Engineering course

Course Content: This course covers the following topics:

- Design and synthesis of digital circuits and microprocessor systems using a hardware descriptive language such as VHDL;
- Verification of circuit network theorems and their applications to circuit designs for maximum power transfer and impedance matching;
- Application of circuit simulation tools (PSPICE, Workbench, Multisim) to the design and analysis of electronic circuits;
- Exploration of interface circuit designs for microcontrollers and their application to embedded system; Exploration of the behaviour of various signals and systems using MATLAB software tool;

Evaluation:

- One Design Project 70%
- 6 Laboratory Reports 30%

P24J/ELET2410 **ANALYSIS AND DESIGN OF ANALOG CIRCUITS**

(3 Credits) Semester 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422, ELET1400 and CAPE Mathematics (or equivalent)

Course Content: This course covers the following topics:

- Basic Concepts of Analog Circuits and Signals;
- Diodes and Applications;
- Transistor circuits**:** AC analysis of transistor amplifiers, Feedback, multistage, RF, and Audio amplifiers; Differential amplifiers; Voltage regulation and regulator circuits;
- Optoelectronics circuits: Light emitting diodes, phototransistor, Optoisolators;
- Operational Amplifiers: Op-Amp Responses, Basic Op-Amp Circuits, Active Filters;
- Linear integrated circuits: The phase lock loop, the 555 timer IC, Other linear ICs;
- Oscillators: Principles of oscillation, types of oscillators;
- Special-Purpose Amplifiers;
- Data conversion circuits;

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour In-course test or equivalent 20%
- Assignments 20%

ELET2415 **PRACTICES IN ELECTRONICS DESIGNS II**

(3 Credits) Semester 2 Level 2

Pre-requisites: ELET1400 and ELET1405

Co-Requisite: Any level 2 Semester 2 Electronics or Electronics Engineering course

Course Content: This course covers the following topics:

- Design and analysis of analogue circuits via hardware designs and software simulations;
- An interactive web-based design and analysis of a motor controller to perform a specific task;
- Application of mathematical modeling to the design of control circuits;
- Design and analyses of digital communication circuits and systems;

- The use of spectrum analyzers and oscilloscopes to analyze electrical communication signals;
- Development and verification of electrical models for semiconductor devices;
- Performance analyses of semiconductor devices and circuits via simulation software (PSPICE) and hardware designs;

Evaluation:

• Six Laboratory reports (equal weighting)	30%
• One major design project	50%
• One 1-hour final examination	20%

P24L/ELET2420 **INTRODUCTION TO SEMICONDUCTOR DEVICES**

(3 Credits) Semester 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422, ELET1400, and CAPE Mathematics (or equivalent)

Course Content: This course covers the following topics:

Semiconductor Fundamentals

- General introduction to semiconductor
  Carrier modelling, energy quantization and probability concepts; energy bands structure, density of states, statistical mechanics; Semiconductor in equilibrium; Carrier transport and excess carrier phenomenon; Carrier Modeling; Carrier Action; Basics of device fabrications;

PN Junctions

- PN Junction electrostatics; PN Junction Diode, I-V Characteristics, small signal admittance, Transient response; Optoelectronic Devices; microwave diodes – tunnel, IMPATT, Gunn;

Bipolar Junction Transistors (BJT)

- BJT fundamentals, static characteristics, dynamic response modelling- equivalent circuits, transient response;
- PNPN Devices: Silicon controlled rectifiers (SCRs); TRIACS, DIACS;

- Metal Semiconductor contacts and the Schottky Diode;
- Circuit application examples for PN junction devices;

Field Effect Devices:

- The JFET and the MESFET; The Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-theory of operation, ID-VD relationships, Threshold considerations; Non Ideal MOSFETs, Modern FET structures Circuit application examples for Field Effect Devices;

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour In-course test or equivalent 20%
- Assignments 20%

<u>P24K/ELET2430</u> **<u>DIGITAL CIRCUITS AND MICROPROCESSORS</u>**

(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422, ELET1400, and CAPE Mathematics (or equivalent)

Course Content: This course covers the following topics:

Digital Logic Design

- Brief review of Combinational logic;
- Flip-Flops and Latches: Synchronous, Asynchronous, Single bit;
- Memory elements, Counters & Shift Registers and Timing;
- System specification using State Diagrams;
- System design using state diagrams and flip-flops;
- The design of multidimensional memory arrays using flip-flops;

Computer Arithmetic

- Unsigned and Signed Integer Representation;
- Signed Magnitude Representation;
- One’s Complement Representation;

- Two’s Complement Representation;
- Floating-Point Representation;
- Fractions Floating-Point Addition, Multiplication and Division;

Processor Organization

- Overview – RISC, CISC, Data Path, Control Unit;
- Operand Types ;
- Addressing Modes;
- Instruction Types;
- Instruction Format: zero, one, two and three address machines;
- Micro-program Control: Hardware and Software implementation, Data Path manipulation;

Cache memory

- Cache Design Basics;
- Mapping Function - Direct Mapping,
- Associative Mapping and Set-Associative Mapping;
- Replacement Policies;
- Write Policies;
- Cache management - Locating a Block and Replacement Policies;

Parallelism

- Pipeline - Basic Concepts;
- Handling Resource Conflicts;
- Data Hazards;
- Register Forwarding;
- Register Interlocking;
- Handling Branches : Delayed Branch
- Execution, Branch Prediction and Performance Enhancements;
- Superscalar Processors ;
- Superpipelined Processors;
- Very Long Instruction Word;
- Architectures ;
- Example Implementations - Pentium and SPARC Processors;
- Vector processors;

Interrupts

- A Taxonomy of Pentium Interrupts;
- Hardware and Software Interrupts;
- Example implementations – Pentium and SPARC Processors;

Evaluation:

One 2-hour theory examination paper	60%
One 1-hour In-course test or equivalent	20%
Assignments	20%

ELET 2450 **EMBEDDED SYSTEMS**

(3 Credits) Semester 1 Level 2

Pre-requisite: PHYS1411, PHYS1412, PHYS1421, PHYS1422, ELET1400, and CAPE Mathematics (or equivalent)

Course Content: This course covers the following topics:

Embedded Systems Overview:

- Introduction and Background;
- An Embedded System;
- Processor in the Embedded System;
- Other Hardware Units;
- Exemplary Embedded Systems;
- Embedded System-On-Chip (SOC) and in VLSI Circuits;

Microcontroller Overview

- Basic Layout;
- Components;
- Memory and Register;
- Instruction Set;
- The AVR 8-Bits Microcontrollers;

Assembly Programming & Simulation

- Assembly Language Structure;
- Branch, Call and time delay loops;
- AVR Studio: Editor, Assembler, Simulator, Debugger and Hex Programmer;
- Simulation of Written Code;
- STK500 Hardware: Description and Operation;
- Actual Microcontroller Programming;

Digital & Analog Capabilities

- Digital Input/Output Capabilities, Configuration and Operation of I/O Ports;
- Digital I/O Port Programming;
- Analog Input/Output Capabilities;
- Configuration and Operation of I/O Pins/Ports;
- Analog-to-Digital Conversion;
- Analog Peripheral Programming;

Interrupt Subsystem:

- Introduction to concept of Interrupts;
- Configuration and Operation of Interrupts Sources;
- External and Internal Interrupts Capabilities;
- Interrupts Control Flow;
- Interrupt Vectors and Vector Table;
- Interrupt Programming;

Timing Subsystem:

- Introduction to timer/counters 8/16-Bits Timers;
- Configuration and Operation of Timers;
- Timers Modes of Operation: Counter, Input Capture, Output Compare and Pulse Width Modulation;
- Watch Dog Timer;
- Timer Programming;

Serial Communication Subsystem:

- Parallel vs. Serial Communication;
- UART and USART;
- Operation and Configuration;
- Serial Communication Protocol: Framing, Parity, etc;
- RS232 Serial Ports Layout (DB25 and DB9);
- RS232 Standard Line Drivers;
- Serial Programming;

C Language for Embedded Systems:

- Introduction to Embedded C;
- C Language vs. Assembly Language
- Introduction to the WinAVR C Compiler;
- C Structure;
- Pre-processor Commands;
- C Types, Operators and Expression;

- C Control Flow (For, While, If/Else, Switch, etc. Control Structure.);
- Function and Program Structure;

Operating Parameters & Interfacing:

- Operating Parameters;
- Interfacing Input Devices, Switches including de-bounce circuit, Keypad and Keypad Drivers, etc;
- Keypad Programming;
- Interfacing Output Devices, LCD, LED, etc;
- LCD Interface Programming;
- Motor Control, DC Motors, Stepper Motors and Their Drivers, Servo Motors and Their Drivers;
- Motor Control Programming;
- Isolators, Optical and Other Isolators;
- Power Supply and Regulation, Oscillators and Clocks;
- Interfacing GPS Receivers;
- GPS NEMA Standard;
- Interface GSM Modems;
- Modems' AT Commands;

Design & Development:

- Design Plans (Project Specifications, etc.);
- Sourcing and Selection of Controllers and Components;
- Designing Circuits;
- Flowcharts and Programs;
- Implementation and Packaging;
- Documentation;

Communication Technology

- Introduction to IrDA;
- Introduction to USB;
- USB Packets;
- USB Physical Interface;
- Implementing USB Interface;

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour In-course test or equivalent 20%
- Assignments 20%

P24F/ELET2460 SIGNALS AND SYSTEMS

(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422, ELET1400, and CAPE Mathematics (or equivalent)

Course Content: This course covers the following topics:

- **Continuous-Time Elementary Signals:** The Unit Step, the Unit Impulse, the Unit Ramp, Sinusoidal Signal;
- **Signal Transformations:** Continuity, Piece-wise continuity; Time shifting, time scaling, time reversal; Convolution; Convolution and Impulse Response;
- **Introduction to Systems**: is a system? Modelling of Physical Systems, Linear Differential Equations, I/O State Space; Properties of Systems (I/O, Linearity, TI, Causality); Testing for System Properties;
- **Frequency Domain Representation of Signals and Systems:** The Fourier Series; Trigonometric Form; Complex Exponential Form; Representation of Periodic Signals; Transform;
- **Transform Domain Representation of Systems**: Laplace Transfer; System Transfer Function; Block Diagrams; Signal Flow Graphs;
- **Time Domain Analysis of Systems:** System Response; Zero Input Response; Zero State Response; Input-Output Relationships for LTI Systems; and the Impulse Response; The Routh-Hurwitz Criterion; Step Response Analysis**;** Frequency Response; Space Analysis;
- **Mathematical Representation of Discrete-Time Signals:** Difference Equations; z-Transform; Inverse Transform; Division Z-Transform Inversion; Fraction Expansion; Equations;
- **Frequency Domain Representation of Discrete-Time Signals:** Discrete-Time Fourier Transforms; Discrete-Time Fourier Series; Discrete Fourier Transforms;

Comparison of Fourier Transforms;

- **Time Domain Representation of Discrete-Time Systems:** System Classification; Discrete Time Systems; Discrete Time Convolution; of Discrete-Time Convolution; of Discrete-time Systems;
- **Transform Domain Representation of Discrete-Time Systems;** Discrete-Time Systems; Stability of Discrete-Time Systems; Time Steady State Response;
- **Filter Design:** Analog Filters; Digital Filters (FIR and IIR Filters);

Evaluation:

- One 2-hour theory final exam paper 60%
- Mid Semester exam 20%
- Assignments 20%

Six take-home problem solving assignment of equal weighting (10%); one paper on a survey of the state-of-the-art in the analogue circuit designs (10%). The report will take the form of that required for an IEEE paper publication.

P24G/ELET2470 **ELECTRICAL CIRCUIT ANALYSIS**

(3 Credits) Semester 1 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422, ELET1400, and CAPE Mathematics (or equivalent)

Course Content: This course covers the following topics:

- Basic concepts: electronic charge,
- current, voltage, power, energy;
- Introduction to circuit theory;
- Simple circuits;
- Kirchhoff's voltage and current laws;
- Series and parallel circuit networks;
- Structured Circuit Theory;
- Network theorems: Superposition,
- Thevenin's, Norton's;
- Solution using structured approach;
- Network analysis: branch, loop, node;
- Source types;
- Maximum power transfer theorem;
- Capacitive and inductive circuits;

- Laplace models;
- Steady state and dynamic responses of simple networks;
- AC steady state analysis;
- Circuit Theory in Laplace domain;
- Transient and steady state solutions Complex number models;
- Complex power;
- Power factor correction;

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour In-course test or equivalent 20%
- Assignments 20%

P24H/ELET2480 **INTRODUCTION TO MODERN COMMUNICATIONS SYSTEMS**

(3 Credits) Semester 2 Level 2

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422, ELET1400, and CAPE Mathematics (or equivalent)

Course Content: This course covers the following topics :

Amplitude Modulation Techniques

- Amplitude Modulation and Demodulation;
- Quadrature Amplitude Modulation;
- Single sideband systems;
- Vestigial sideband Modulation;
- Suppressed Carrier Amplitude Modulation;

Angle Modulation Techniques

- Properties of Angle Modulation;
- Relationship between PM and FM waves;
- Wide-band and narrow-band Frequency Modulation;
- Generation of Angle Modulated waves;
- Demodulation of Angle Modulated signals;

Sampling & Digital Modulation Techniques

- Sampling and Sampling Theorem;
- Quantization and Bit rates;
- Pulse Amplitude Modulation (PAM);
- Pulse Code modulation (PCM);

- Pulse Width Modulation (PWM);
- Delta Modulation (DM);

Baseband Data Transmission

- Baseband transmission of digital data;
- Intersymbol Interference (ISI);
- The Nyquist Channel;
- Baseband transmission of M-ary Data;
- The Eye Pattern;
- Bandpass modulation techniques;
- Binary Amplitude-Shift Keying;
- Phase-Shift Keying;
- Frequency-Shift Keying;
- M-ary digital modulation schemes;

Random Signals and Noise

- Probability and random variables;
- Gaussian random variables;
- Random processes;
- Gaussian processes;
- White noise;
- Narrowband noise;

Noise in Analog Communications

- Noise in communication systems;
- Signal-to-noise ratio;
- Noise factor and Noise figure;
- Noise in linear systems using Coherent Detection;
- Noise in AM Receivers using Envelope Detection;
- Noise in SSB Receivers;

Noise in Digital Communications

- Bit Error Rate;
- Single pulse detection in Noise;
- Optimum detection of PAM in Noise;
- Optimum detection of BPSK;
- Detection of QPSK and QAM in Noise;
- Differential Detection in Noise;

Wireless Communication

- Propagation loss in a simple wireless Link;
- Principles of Radio and Television;
- Facsimile;
- Cellular technology and Global; Positioning Systems (GPS);

- Brief Introduction to GSM technology;

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour In-course test or equivalent 20%
- Assignments 20%

PHYS3200 **GENERAL PHYSICS LAB 2**

(3 Credits) Semester 2 Level 3

Pre-requisites: PHYS2300

Co-requisites: PHYS3351 and PHYS3386

Course Content: This course covers the following topics:

- The Skin Effect
- Electromagnetic Reflection and Refraction - Fresnel's Equations
- Microwave Propagation
- Measurement of the Speed of Light
- The Milikan Oil Drop Experiment
- Numerical Solution of Laplace's Equation on a Grid with Dirichlet or Neumann Boundary Conditions
- Variation of the Wave Function (ψ) with Potential Energy (V)
- Energy Levels of the Deuteron
- Relativity (Kinematics)
- Calculation of the Mass of A^0 Particle
- Relativity (Dynamics)

In a particular semester experiments may also be added from other topics in electromagnetism and modern physics

Evaluation:

- One 4-hour final practical examination 50%
- Ten laboratory reports (equal weighting) 20%
- One 2-hour in-course practical test 30%

PHYS3300 **ADVANCED PRACTICES IN MEDICAL PHYSICS**

(3 Credits) Semester 1 Level 3

Pre-requisites: PHYS2200

Course Content: This course covers the following topics:

- Biomechanics: Gait Analysis using a modern mobile phone
- Optics of the eye
- Dual Energy X-Ray Absorptiometry
- Physics of Gamma Spectroscopy in Nuclear Medicine
- Image analysis and processing using ImageJ and Matlab
- Research project
- Inverse Square Law in medical diagnostics

Evaluation:

- Six laboratory reports 40%
- One oral presentation 25%
- One written project report 35%

PHYS3341 BIOMEDICAL OPTICS AND BIOMECHANICS

(3 Credits) Semester 1 Level 3

Pre-requisite: PHYS2296

Course Content: This course covers the following topics:

- **Optics in Medical Physics:** Image formation and interferometry; theory of optics; tissue optics and optical microscopy; optical coherence topography and acousto-optics microscopy; lasers application in medicine; applications of microscopy and spectroscopy in medicine; tissue-light transport modeling using e.g. MatLab and image analysis

- **Biomechanics in Orthopaedics:** Analysis of forces of bones and tissues with heavy focus on the spine; mechanical aspects of fractures; joint replacement and Gait analysis; biomechanics and orthopaedic disorders

- **Biomaterials:** Types of biomaterials and their use; properties of biomaterials; preparation of biomaterials for implantation

- **Ethical/legal aspects**: Current and future ethical and legal implications associated with the use of biomaterials and nanoparticles in the treatment of diseases and similar dilemmas will be explored.

Evaluation:

• One 2-hour theory examination paper	50%
• One 1-hour In-course test or equivalent	20%
• Four in-class quizzes	5%
• One term paper	10%
• Three assignments	15%

PHYS3351 **MODERN PHYSICS 2**

(3 Credits) Semester 2 Level 3

Pre-requisite: PHYS2351

Course Content**:** This course covers the following topics:

Quantum Mechanics

- Simple Harmonic Oscillator
- Hydrogen-like Atom
- Quantum Numbers
- Non-degenerate Pertubation Theory
- Varioational Principle

Relativity

- Lorentz Transformation Equations
- Simultaneity
- Time Dilation
- Length Contraction
- Velocity Addition
- Minkowski's Spacetime Diagrams
- Spacetime Interval
- Twin Paradox
- Four Vector Formalism
- Doppler Effect
- Relativistic Mass

- Momentum and Kinetic Energy
- Relativistic Collisions

Evaluation:

• One 2-hour theory examination paper	70%
• Two 1-hour In-course test or equivalent	10%
• Six Tutorials	6%
• Four Surprize Quizzes	4%
• Projects	10%

P33K/PHYS3386 **ELECTROMAGNETISM**

(3 Credits) Semester 2 Level 3

Pre-requisites: ELET2480/P24H or PHYS2386

Course Content**:** This course covers the following topics:

Review of Vector Analysis and Vector Calculus

- Derivation of Maxwell's equations in differential form;
- Equation of continuity; Poisson's equation;
- Derivation of the electro-magnetic wave equation;
- Solution for plane waves in dielectrics;
- Electro-magnetic nature of light;
- Energy flow and the Poynting vector; Boundary conditions;
- Reflection and refraction of electro-magnetic waves at dielectric boundaries; Derivation of Snell's law;
- Fresnel's equations; Total reflection; Brewster's angle;
- Transmission and reflection co-efficients;
- Propagation of electro-magnetic waves in conducting media;
- Skin depth; Energy flow in conductors; Reflection of Electro-magnetic waves by a conductor;
- Dispersion of electro-magnetic waves in various media;
- Sources of electro-magnetic waves;

Evaluation:
(Overall Theory and Practical to be passed separately):

- One 2-hour theory examination paper 70%
- One 1-hour In-course test or equivalent 20%
- Practical work 10%

PHYS3389 **MEDICAL RADIATION PHYSICS AND IMAGING**

(3 Credits) Semester 2 Level 3

Pre-requisites: PHYS2296

Course Content: This course covers the following topics:

Physics of X-ray Diagnostic Radiology

- X-ray Production and interaction with matter, Operation and diagnostic of X-ray tubes, Instrumentation for X-ray imaging, X-ray Computed Tomography;

Radioactivity and Nuclear Medicine

- Physics of Nuclear medicine, Radioactivity and radionuclides, Single Photon Emission Computed Tomography, Position Emission Tomography;

Physics and Instrumentation of diagnostic medical ultrasonography

- Principles of ultrasonic imaging; Instrumentation for diagnostic ultrasonography; Image characteristics; Medical applications of ultrasound;

Physics of Magnetic Resonance imaging

- Quantum mechanics and nuclear magnetism; Instrumentation, Magnetic Resonance Imaging; Magnetic resonance angiography, Medical applications;

Radiation Dosimetry and protection

- Principles of radiation protection, Units of exposure and dose, Radiation detection and measurement;

Evaluation:

- One 2-hour paper 50%
- One 1-hour Theory Course Work 10%
- Practical Course Work 40%

P33L/PHYS3395 **ASTRONOMY & COSMOLOGY**
(4 Credits) Semester 2 Level 3

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Course Content**:** This course covers the following topics:

- The celestial sphere, Celestial mechanics, Co-ordinate systems, Sidereal Time;
- Telescopes and their capabilities;
- The Solar System, Stellar Radiation, Magnitudes, Classification; Stellar Structure, Binary Stars;
- Distance measurements and the distance ladder; hour diagram;
- Stellar Evolution and Endpoints;
- The Milky Way; Other galaxies;
- Cosmological Distance methods;
- The structure of the Universe;
- Introductory Cosmology;
- Simple Cosmological Models;
- Observational Cosmology;
- The Age of the Universe;
- The Big Bang;

Evaluation:
(Overall Theory and Practical to be passed separately):

- One 2-hour theory examination paper 70%
- One 1-hour In-course test or equivalent 20%
- Practical work 10%

P33M/PHYS3399 **RESEARCH PROJECT (NON ELECTRONICS)**
(4 Credits) Semester 1 or 2 Level 3

Pre-requisites: Students must (i) qualify for one of the Physics Majors offered by the department; (ii) get permission from the Head, and (iii) satisfy any additional criteria deemed necessary by the department.

Course Content: Students will consult staff members with whom they wish to work about possible topics. If pre-requisites are met and permission granted, the staff member will be assigned to supervise the student. Staff member will assign reading list and meet weekly with the student. Staff members may assign research tasks to teach particular skills. Written report and oral presentation as a seminar on the approved topic are required at end of course.

Evaluation:

- Course Work (Assignments) 30%
- Oral Presentation 10%
- Written Report 60%

PHYS3500 **ADVANCED MATERIALS SCIENCE LABORATORY**

(3 Credits) Semester 1 Level 3

Pre-requisites: PHYS2500

Course Content: This course covers the following topics:

- Synthesizing and characterizing materials
- Synthesis techniques:
  - solid state powder/fibre processing for metal, ceramic and composite samples
  - calcination, green body formation and sintering
  - wet chemical processing
  - simple polymerization
- Characterization techniques:
  - Test for porosity/density, electrical conductivity, elastic modulus, fracture toughness, flexural strength, and compressive strength,
  - Fourier Transform Infrared spectroscopy (FTIR),
  - X-ray diffraction (XRD),
  - X-ray fluorescence (XRF)

Evaluation:

- Two written reports 40%
- Five laboratory reports 20%
- Two oral presentations 40%

PHYS3561 **THE PHYSICS OF CRYSTALLINE MATERIALS**

(3 Credits) Semester 2 Level 3

Pre-requisite: PHYS2561

Course Content: To be announced

Evaluation: To be announced

PHYS3562 **THE PHYSICS OF NON-CRYSTALLINE AND AMORPHOUS MATERIALS**

(3 Credits) Semester 1 Level 3

Pre-requisite: PHYS2561

Course Content: This course covers the following topics:

- Introduction to non-crystalline and amorphous materials (polymers, glasses, etc.)
- Structure and chemistry of amorphous and non-crystalline materials: molecular structure of polymers; polarization and defects; thermoplastic and thermosetting polymers; crystallinity and elastomers
- Glass: formation, structure and transition temperature,
- Thermodynamics of glass formation;
- kinetics of glass formation
- Properties of amorphous and non-crystalline materials: mechanical, electrical, thermal, dielectric, and optical

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour In-course test or equivalent 20%
- One graded assignment 10%
- Two graded tutorials 10%

PHYS3565 **THERMODYNAMICS AND MATERIALS**

(3 Credits) Semester 2 Level 3

Pre-requisite: PHYS2561

Course Content: This course covers the following topics:

- Review of Zeroth First, Second and Third laws of thermodynamics;
- The concept of time dependent processes and implications; examples of kinetic processes
- Gibb's free energy; enthalpy, entropy, equilibrium, mass action expressions
- Phase equilibria; unary and binary phase diagrams; Gibbs Phase Rule; Lever Rule
- Development of microstructure; Binary Eutectic Systems; Ceramic systems
- Kinetics of phase transformations; the Avrami Equation; Ostwald ripening (coarsening), thermodynamics of curved surfaces (capillarity).
- The surface state; Energetics of the surface; Bulk versus surface properties; Nanomaterials (surface-dominated materials).
- Solid-solid interfaces; Solid-liquid interfaces; Solid-gas interfaces and the Nernst Equation; Wetting; Hydrophilic and hydrophobic materials; Composites (interface-dominated materials), e.g., asphalt, concrete, fiberglass.

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour In-course test or equivalent 20%
- One graded assignment 10%
- Two graded tutorials 10%

PHYS3661 **PHYSICS OF THE ATMOSPHERE AND CLIMATE**

(3 Credits) Semester 2 Level 3

Pre-requisites: PHYS1411, PHYS1412, PHYS1421, PHYS1422

Course Content: This course covers the following topics:

Survey of the Atmosphere

- Composition of the lower, middle and upper atmosphere; diffusive equilibrium; photo-chemical processes and thermal structure;

Atmospheric Thermodynamics

- Dry air-adiabatic processes, potential temperature, entropy, equation of state; moist air-Clausius-Clapeyron equation, virtual temperature, vapour pressure, relative humidity, and condensation; atmospheric aerosols, clouds-formation and growth;

Radiative Transfer

- Absorption and emission of atmospheric radiation, Greenhouse effect and global warming;

Atmospheric Dynamics (qualitative derivations)

- Real and apparent forces in a rotating co-ordinate system, equations of motions and the Geostropic approximation, gradient wind;

General circulation of the Tropics

- Brief overview of general circulation; Hadley and Walker cells; ITCZ; El Nino-Southern Oscillation, trade winds, and climate variability;

Evaluation:

- Two 1-hour In-course tests of equal weighting 40%
- One 2-hour final written examination 60%

P36C/PHYS3671 **SOLAR POWER**

(3 Credits) Semester 1 Level 3

Pre-requisite: PHYS3661

Course Content**:** This course covers the following topics :

- The characteristics and measurement of solar radiation
- Analysis and design of flat plate collector systems
- The operation, design and application of Photovoltaic (PV) cells and systems
- Qualitative analysis of the Rankine cycle
- Solar thermal power systems
- Principles of operation of ocean thermal energy conversion (OTEC)
- Absorption refrigeration and solar cooling

Evaluation:

- One 2-hour theory examination paper 50%
- Two 1-hour In-course test or equivalent 20%
- Six graded Tutorials 10%
- One seminar-based group presentation 20%

P36D/PHYS3681 **WIND AND HYDRO POWER**

(3 Credits) Semester 2 Level 3

Pre-requisites: PHYS2671 and PHYS3661

Course Content: This course covers the following topics:

Wind Power

- Overview of global wind power, wind types and classes, and its physical characteristics
- Wind resource assessment: Anemometry and site prospecting.
- Introduction to basic statistics: Weibull and Rayleigh distributions.
- Wind energy and power density calculations.
- Components and basic operation of WEC (Wind Energy Conversion) systems and turbine types.
- Horizontal and vertical axis turbines.
- Conversion of wind power to electrical power.
- Factors affecting turbine performance and efficiency.
- Wind farms designs and installations
- Economic analysis and environmental considerations
- Wind hybrid systems (solar, diesel, hydro) and other applications of wind power.
- Energy storage: batteries, flywheels, compressed gas.

Hydro Power

- Hydrologic (water) cycle, global hydro power, and hydro resource assessment.
- Analysis of power losses in pipes Moody diagrams, and the
- Operating principles and the characteristics of selected turbines
- Criteria for selection of a particular turbine
- Concepts of gross head, net head, energy line, hydraulic grade line and available head
- Conversion of hydro- power to electrical power: Shaft torque and shaft power.
- Energy storage: pumped storage facilities.

- Economic analysis and environmental considerations

Evaluation:

- One 2-hour theory examination paper 50%
- Two 1-hour In-course test or equivalent 20%
- Six graded tutorials 10%
- One seminar-based group presentation 10%

ELET3405 **PRACTICAL ANALYSIS OF ADVANCED ELECTRONIC CIRCUITS AND SYSTEMS**

(3 Credits) Semester 1 Level 3

Pre-requisites: ELET2405 and ELET2415

Course Content: This course covers the following topics:

Practical analysis of advanced electronic circuits and equipment

- This section will run for the first five weeks of the semester. Students will carry out diagnosis and repairs of general purpose electronic circuits and equipment. These include power supplies, battery backup systems (e.g. UPS), inverters, computer mother boards and peripherals, electronic consumer appliances, light projectors, and electronics test equipment (oscilloscopes, meters, etc.);

Practical analysis of telecommunication circuits, devices and systems

- This section will run concurrently with section 3 and targets the students who specialized in telecommunications. Students will perform diagnostics and repairs of telecommunication circuit and systems. These include radio frequency (RF) transmitters and receivers, antennas and antenna placements, software tools, signal strength measurements, bandwidth verification and control, optimization of telecommunication networks, field strength measurements using spectrum analyzers, up-link and down-link communication with satellites via antennas on Physics Dept roof, fiber optic networks and components, and 3G and 4G equipment and implementations. Wherever possible, actual industry diagnostics tasks will be assigned in collaboration with our industry partners;

Practical analysis of instrumentation and control systems

- This section will run concurrently with section 2 and targets the students who specialized in Instrumentation and control. Students will perform diagnostics and repairs of instrumentation and control systems. These include sensor analysis and calibration, instrument repair and calibrations, industrial motors and their controllers, industrial power supplies and power systems, programmable logic controllers (PLC) and PLC programming, control room operation, fault finding in industrial control system loops, and optimization of automation processes. Wherever possible, actual industry diagnostics tasks will be assigned in collaboration with our industry partner;

Evaluation:

- One 4 hours final practical exam 40%
- Five laboratory reports (equal weighting) 20%
- Eight industry-type technical reports (equal weighting) 40%

ELET3430 **INSTRUMENTATION AND MEASUREMENTS**

(3 Credits) Semester 1 Level 3

Pre-requisite: ELET2410/P24J and ELET2430/P24K

Course Content: This course covers the following topics:

Measurement systems and standards

- Measurement system architecture;
- Errors in measurements;
- Standards used in measurements;

Electrical and electronic measurements

- Units and standards;

- Electrical measuring instruments- AC voltages and currents Magnetic fields; phase; resistance, capacitance and inductance measurements; vector impedance meters; power and energy measurements; magnetic measurements; process parameter measurements; displacement, force, torque, dimension, density, viscosity, pH, level measurements, flow, pressure, temperature;
- DC voltages and currents; static electric field;

Sensors and transducers input mechanisms

- Categories of sensors – resistive, voltage generating, variable magnetic coupling, variable capacitance, fiber optic, photomultiplier tubes, ionizing radiation sensors, electronic noses, electrochemical, mechano-electrochemical, velocity sensors, mass flow meters, industrial sensors; Application of sensors to physical measurements;

Analogue and digital signal conditioning

- Differential amplifiers; operational amplifiers; instrumentation amplifiers; active analogue filters, signal processing, charge amplifiers; digital filters; DSP techniques;
- Interfacing with digital systems;
- Sampling techniques; ADC and DAC; digital data transmission;

Noise and coherent interference in measurements

- Noise in circuits; circuit optimization to reduce noise; low noise designs; coherent interference and its minimization;
- AC and DC Null measurements;
- AC and DC Wheatstone Bridge; Kelvin bridge; Anderson constant current loop; Equivalent AC circuits for passive components; AC bridges; Null methods of measurements;

Design of measurement systems

- Capacitive sensor for the detection of hidden object; electric field sensors; velocity meters; industrial systems;

Evaluation:

- One 2-hour theory examination paper 60%

- One 1-hour In-course test or equivalent 20%
- Case Study of an Industrial Measurement System 20%

ELET3440 **INTRODUCTION TO ROBOTICS**

(3 Credits) Semester 2 Level 3

Pre-requisite: ELET2430 and ELET2450

Course Content: This course covers the following topics:

- What is Robotics? Brief History of Robotics; The Basics Robot; Examples of Robots
- Robots & Embedded Controllers:
- Design of Robot Platforms; Robots Embedded Controllers; Interfacing Controllers with External Device
- Software/Hardware Development Tools:
- Code Compilers; Code Assemblers; Code Simulation/Debugging Software; Hardware Programmers
- Sensors& Sensor Interfacing:
- A Comparison of Analog vs. Digital Sensors; Converting Analog Signals to Digital; Operation and Interfacing of various Sensors
- Actuators& Actuator Interfacing:
- Theory of H-Bridge Operation; Pulse Width Modulation; DC Motors Operation and Interfacing; Servo Motors Operation and Interfacing; Stepper Motors Operation and Interfacing
- Robot Related Control:
- On-Off Control; PID Control; Velocity and Position Control; Multiple Motors Control
- Wireless Communication for Robots:
- Basic layout of Communication System; Design of Simple Wireless Communication System; Remote Control of a Robotic Platform
- Mobile Robot Design:
- Exploring Designs for Driving Robot; Exploring Designs for Walking Robots; Exploring Designs for Autonomous Robots
- Robot Applications:
- Discussions on selected robot based applications, such as Industrial Robots, Maze Exploration Robots

- Emerging Topics:
- Selected topics from new developments in the field of robotics.

Evaluation:

- One 2-hour theory examination paper 60%
- Course Work: 40%
- One 1-hour in-course test 10%
- Two written assignments 10%
- Three practical assignments 20%

ELET 3450 **SATELLITE COMMUNICATION & GLOBAL NAVIGATIONAL SATELLITE SYSTEMS**

(3 Credits) Semester 2 Level 3

Pre-requisite: ELET 2480

Course Content: This course covers the following topics:

- **Satellites and Telecommunication:** Introduction and Background Satellite Services and Applications Telecommunication User and Applications: Broadcast Mobile and Navigational Services;
- **Communications Fundamentals:** Basic Definitions and Measurements: Overview of Spectrum, Wave Properties, Modulation and Multiplexing: Analog and Digital Signals Capacity;
- **The Space Segment:** Space Environment: Orbit Types, Slots, Spacing: Launch Related Information Satellite Systems and Construction;
- **The Ground Segment:** Earth Stations, Antenna Properties, Space Lost, Electronics, EIRP, etc. Signal Flow;
- **The Satellite Earth Link:** Atmospheric Effects, Climate Models, Link Budget, Multiple Access, and Demand Assignment, On-Board Multiplexing;
- **Satellite Communications Systems:** Communication Providers; Competitor and

Competitiveness; System and Operators: Issues, Trends and Future;

- **Fundamental of Satellite Navigation Systems:** Brief History; Longitude and Time; Astronomical Methods: Radio navigation; Inertial Navigation; Satellite Navigational Systems;
- **The GPS System:** System Architecture; Space Segment; Control Segment; Coordinate Frame and Time Reference;User Segment; Signal Structure; Receiver, Signal Power Measurement and Performance; Signal Acquisition and Tracking; Estimation of Position, Velocity and Time; Error Sources and Correction methods;
- **Future GNSS:** GPS, Galileo, GLONASS and Compass; Frequency Allocation and Plan; Spreading Code and Ranging Signal; Compatibility and Interoperability;
- **GPS Coordinate Frames, Time Reference and Orbits:** Global Coordinate Systems; Terrestrial and Inertial Systems; Geodetic Coordinates Time References and GPS Time; GPS Orbits and Satellite Position Determination; GPS Orbital Parameters; GPS Navigational Message; GPS Constellation and Visibility Display.
- **GPS Measurements and Errors Sources:** Measurement Models, Code Phase Measurement; Carrier Measurements; Error Sources: Clock, Multipath, Atmosphere, Receiver, etc. Error Mitigation.
- **GNSS Applications:** Navigation; Tracking; Crustal Movements; Farming etc.

Evaluation:

- One 2-hour final exam 60%
- Course Work 40%

P34F/ELET3460 DIGITAL SIGNAL AND IMAGE PROCESSING

(3 Credits) Semester 2 Level 3

Pre-requisite: ELET 2460/P24F

Course Content: This course covers the following topics:

PART 1: DIGITAL SIGNAL PROCESSING

- **Review of areas covered at Level 2 Signal and Systems:**
  - Overview A/D and D/A Conversion, Sampling, Quantizing and Encoding, I/O devices, DSP hardware, Fixed and floating point devices; Frequency Domain analysis; DSP Fundamentals
- **Digital Filter Design:**
  - FIR and IIR filters. Linear phase FIR filters; All Pass filters. Implementing FIR Filters; Window approach; Linear phase types 1-4; Optimal fit Algorithms. Implementing IIR filters; Bi-linear and Impulse Invariant Transforms
- **DSP Structures:**
  - Direct Form 1 & 2 Structures. Effects of Signal Digitisation; Signal Sampling and Reconstruction; Effects of Finite Number Operations; Use of second order sections; Noise and instability. Structure and use of Adaptive Filters; Least-squares error requirement for adaptive filter design

PART 2: DIGITAL IMAGE PROCESSING

- **Introduction to Digital Image Processing:**
  - Image Acquisition; Representing Digital Images; Pixel Relationships
- **Basic Image Operations:**
  - Histogram Equalisation; Histogram Matching; Image Subtraction; Image Averaging
- **Frequency Domain Image Enhancement:**
  - Use of the Fourier Transform in Image Enhancement; Fourier Transform-based Smoothing ; Fourier Transform-based Sharpening
- **Image Compression:**

        - Error-free Compression; Lossy Compression; Image Compression Standards
- **Image Segmentation:**
- Point Detection; Line Detection; Edge Detection

Evaluation:
- One 2-hour theory examination paper 60%
- One 1-hour in-course test 20%
- Five take home assignments (equal weighting) 20%

<u>ELET3470</u> **<u>WAVE TRANSMISSION AND FIBER OPTICS</u>**

(3 Credits) Semester 1 Level 3

Pre-requisite: PHYS2386 or ELET2480

Course Content: This course covers the following topics:

The electromagnetic wave and field energetics

- Maxwell's equations in integral and differential forms, the electromagnetic wave, electric power density, Poynting's theorem, field energetics. Complex fields, polarization: linear and circular. Group velocity, dispersion relation, wave velocities, complex Poynting's theorem, complex permittivity, load impedance;

Waves in conducting media and across interfaces

- Wave equation in conductors; Waves in good insulators, waves in good conductors, transition frequencies; boundary conditions, normal incidence with matched impedances, impedance mismatch, reflection and transmission coefficients, energy transmission and reflection, insulator; conductor interfaces, antireflection coating. Oblique waves as nonuniform transverse waves, Snell's law, TE and TM polarization, Brewster angle, power conservation. Reactive impedances, total internal reflection (TIR), TIR for TE and TM polarizations. Skin effect in coaxial conductors;

Transmission lines

- Non-uniform waves, electrostatic solutions, coaxial line, voltage and current waves, characteristic impedance, mismatched loads, standing waves ratio, impedance measurements, reflection coefficients, input impedance of a line, the Smith Chart, transmission and reflection coefficients (S_{21} and S_{11}), half-wave and quarter-wave transformers, matching stubs, transmission lines on printed circuit boards: microstrip, co-planar, slot line; EMI from PCBs, impedance matching in high speed circuits;

Waveguides

- Generalized non-uniform wave, Helmholtz solution, TE and TM waves, rectangular waveguides, cut-off frequencies, power flow, group and phase velocities in waveguide, cylindrical waveguides, Bessel function;

Antennas

- The elementary dipole, near and far field, radiated power, radiation resistance, radiation pattern, power gain, effective aperture. The half-wave dipole and other harmonics, effects of ground reflection, directors and reflectors, Yagi antennas. Travelling wave antennas, V-antennas, Loop antennas, patched antennas, phased-array antennas, and trend in modern antenna designs. Matching antenna and transmission line, T-Match, Gamma match and Delta match;

Dielectric cylinders and optical fibers

- Step-index fiber, hybrid modes, Derivation of characteristic equation, HE and EH modes, TE and TM modes, Dominant mode;

Practical versions of optical fibers

- Numerical aperture, LP modes, Single-Method fiber, attenuation, material and multi-Method dispersion, graded-index fibers, wave launching, Method coupling;

Fiber optic communication systems design

- System components; signal measurements, chromatic dispersion, the eye diagram, optical return loss; optical circuits and components;

Evaluation:

- One 2-hour theory examination paper 60%
- Two 1-hour In-course test or equivalent 40%

ELET3480 **WIRELESS COMMUNICATION SYSTEMS**

(3 Credits) Semesters 1 Level 3

Pre-requisite: ELET2480

Course Content: This course covers the following topics:

- Introduction to wireless communication systems;
- Modern Wireless communication systems: 2G, 2.5G and 3G technologies.
- Introduction to 4G technologies;
- The cellular concept: system design fundamentals;
- Mobile radio propagation: large scale path loss; small scale fading and multi-path;
- Modulation techniques for mobile radio
- Equalization, Diversity and Channel coding;
- Speech Coding;
- Multiple access techniques for wireless communications;
- Wireless networking;
- Wireless systems and standards;

Evaluation:

- One 2-hour theory examination paper 60%
- One 1-hour in-course test 20%
- Five take-home assignments (averaged) 20%

P34P/ELET3490 **ELECTRONICS PROJECT**

(4 Credits) Semesters 1 & 2 Level 3

Pre-requisites: ELET2410 or ELET2450

Course Content: This course covers the following topics:

- Projects will normally be selected from a list approved by the academic staff;
- A supervisor is assigned to each project which requires about 100 hour of work done over two semesters;
- Design, testing and construction of selected electronics hardware and/or software may be included in the work;

Evaluation:

- On-the-job performance 60%
- Written report 30%
- Oral presentation 10%

<u>ELET3600</u> **<u>ENERGY SYSTEMS LABORATORY</u>**

(3 Credits) Semester 1 Level 3

Pre-requisite: PHYS3671 and PHYS3681

Co-requisites: ELET3611

Course Content: This course coves the following topics:

- Programming e.g. the Nomad 2 wind data logger and performing data analysis.
- Wind mapping using suitable computer software (e.g WindMap)
- Economics of hybrid energy systems
- Field visits to hydro and wind power facilities
- Clear sky model for solar insolation on horizontal surfaces
- Efficiency analysis of a flat-plate solar collector
- I-V characteristics of a solar cell
- Design and installation of a solar energy system
- Design and construction of rectifier, inverter and transformer circuits
- Build a transmission network
- Conduct load (power) flow contingency analysis for base-case load flow and short
- Circuit study and fault analysis for various system load and network additions

Evaluation:

- One 4-hour final practical examination 40%
- Ten laboratory reports (equal weighting) 40%
- One group seminar presentation 20%

P36E/ELET3611 **INTEGRATING ALTERNATIVE ENERGY**

(3 Credits) Semester 2 Level 3

Pre-requisite: ELET2420/P24L

Co-requisites: PHYS3671 and PHYS3681

Course Content: This course coves the following topics:

- Electrical energy systems and their connectivity
- Generator characteristics and applications
- Networking and transmission of electricity
- Power control and management
- Application of power electronics devices
- Regulations, policies, Kyoto and Copenhagen protocols and emission targets
- Energy economics and the pricing of electricity

Evaluation:

- One 2-hour theory examination paper 50%
- Two 1-hour In-course tests 20%
- Six graded tutorials (equal weighting) 10%
- One seminar-based group presentation 20%

Other Programme & Foundation Course

BSc.

Science, Media and Communication

FOUNDATION COURSE

Science, Medicine and Technology in Society

(FD12A/FOUN1201)

BSc. SCIENCE AND MEDIA AND COMMUNICATION

This BSc contains a named Science major AND a Media and Communication major (i.e. double major)

The Option will be taught jointly by The Caribbean Institute of Media and Communication and Departments in The Faculty of Science and Technology Including the Biochemistry Section (Department of Basic Medical Sciences). It is designed to produce a science graduate with expertise in Media and Communication.

Entry requirements
(a) Satisfy the University requirements for normal matriculation and have obtained passes at CXC Secondary Education General Proficiency Level (or equivalent) in Mathematics, and two approved science subjects at GCE Advanced Level (or equivalent);
(b) Obtain a pass in the CARIMAC Entry Examination;
(c) Undergo mandatory academic counselling

LEVEL 1
At least one (1) FST subject must be followed over two semesters

Semester I
JOUR1004 -Principles and Practice of Journalism*/IMMCC1010/IMMCC1268 (3 credits)
COMM1001- Communication, Culture and Caribbean Society (3 credits)
FST course
FST course

Semester 2
JOUR1001 - Writing for Journalism*(3 credits)
COMM1121 - Understanding the Media (3 credits)
FST course
FST course

LEVEL 2
One (1) FST subject should be followed over two semesters

Semester 1
JOUR2001 - Print Journalism Basic*(3 credits)
COMM2201 - Introduction to Communication Research Methods (3 credits)
JOUR2004 - Broadcast Announcing Presentation (3 credits)
FST course

FST course

Semester 2
JOUR2401 - Radio Journalism*(3 credits)
JOUR2801 - Television Journalism*(3 credits)
COMM2110 - Media Ethics and Legal Issues (3 credits)
FST course
FST course

LEVEL 3
One (1) subject chosen at Level 2 should be followed over two semesters, leading to a major

Semester 1
JOUR3801- Television Journalism Advanced* (3 credits)
JOUR3301- Print Journalism II (3 credits)
COMM3399 - Media, Research and Production (6 credits)
FST course
FST course

Semester 2
COMM3399 - Media, Research and Production
JOUR2801-Broadcast Journalism- Television II
Media Specialization Course
FST course
FST course

*Minor-Students can choose two of the following:
JOUR2301/JOUR2401/JOUR2801

Foundation Courses:
FOUN1401 OR FOUN1019- Critical Reading and Writing in Science and Technology and Medical Science OR Critical Reading and Writing in the Disciplines
FOUN1101- Caribbean Civilization
FOUN1301- Law, Governance, Economy & Society

NB: FOUN1101 or FOUN1301 can be substituted with a foreign language course.

SCIENCE, MEDICINE AND TECHNOLOGY IN SOCIETY (FD12A/FOUN1201)

Students within the Faculty of Science and Technology MUST NOT pursue this course

Aim: To develop the ability of the student to engage in an informed manner in public discourse on matters pertaining to the impact of science, medicine and technology on society.

Objectives: On completion of this module the students should be able to:

- Describe the characteristics of science that distinguish it from other human pursuits and so distinguish between science and non-science;
- Recognize Science as a natural human endeavor and explore some of the attempts made by mankind over time to make maximum use of the environment for personal and societal benefit (including a Caribbean perspective);
- Explore modern western science as one way of Knowing and as a mode of enquiry;
- Appreciate that in science there are no final answers and that understanding in all areas is constantly being reappraised in the light of new evidence;
- Describe the characteristics of technology, distinguish between science and technology and discuss the relationships between the two;
- Discuss in a scientifically informed manner the pros and cons of issues arising from some current scientific, medical and /or technological controversies.

Course Content:

Module 1

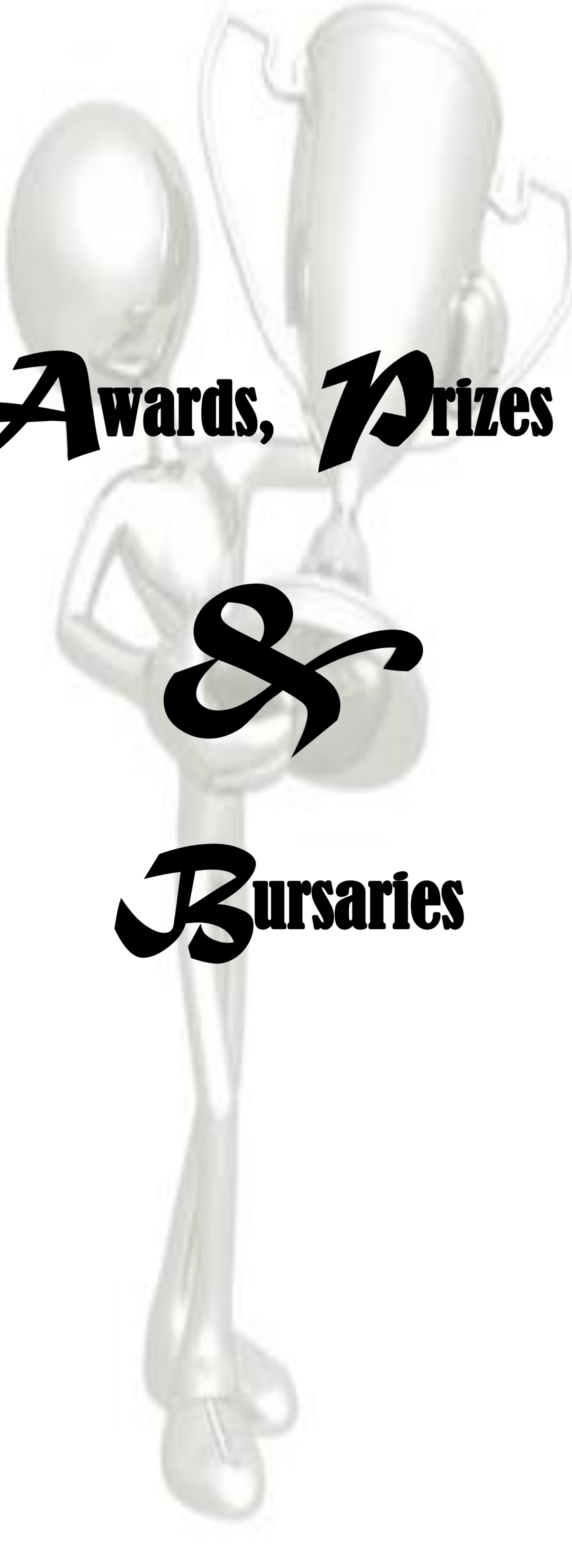
- Unit 1:Issues of Current Interest-Introduction
- Unit 2: Induction and Deduction
- Unit 2: The Hypothetico-Deducative Approach: Scientific Fact and Changing Paradigms
- Unit 2: Observation and Experimentation
- Unit 3: The relationship between Science, Medicine and Technology

Module 2

- Unit 1: Energy: Sources and Usages
- Unit 2: Health and Disease in Society
- Unit 3: Information Technology and Society
- Unit 4: Biotechnology and Society: Genetically Modified Organism
- Unit 5: Ethical and Gender Issues

Evaluation:
Each module will be followed by a 2-hour examination; Fifty (50) Multiple Choice Questions and one (1) essay question.

- Module 1 50%
- Module 2 50%



Awards, Prizes

&

Bursaries

DEPARTMENT OF CHEMISTRY

- **The L.J. Haynes Award**

Professor Leonard J. Haynes joined the staff of the Chemistry Department, University College of the West Indies in 1956. A Natural Products Chemist by training, he was instrumental in launching the Mona Symposium in 1966 and it remains the longest running Natural Products conference of its kind within the Caribbean.

He served the Department as Professor, carrying out research and lecturing in Organic Chemistry, and was the second Head of Department, leaving in 1968.The award named in his honour is presented annually to the student with the best academic performance in the Introductory Level Chemistry courses CHEM1901/1902 and who is proceeding to Level 2 courses. Seed funding for the award came from a donation made by his widow Mrs. Mary Haynes, in January 1994 and the award was first handed out in 1998. The awardee should not be in receipt of any other Chemistry Department prize in the year of consideration.

- **The Chemistry Department Prize**

The Chemistry Department Prize is awarded to a student who has the second best academic performance in the Introductory Level Courses CHEM1901/1902 in Chemistry and who is proceeding to Level 2 courses. The awardee should not be in receipt of any other Chemistry Department prize in the year of consideration.

- **The Pavelich/Honkan Prize**

Michael Pavelich, Professor of Chemistry at the Colorado School of Mines, U.S.A., spent a year as a visiting Professor in the Department of Chemistry as a sabbatical replacement for Professor Tara Dasgupta during 1984-85. At the end of his stay he donated funds towards a prize to recognize scholarship and excellence among Level 1 students. Dr. Vidya Honkan completed her PhD degree in Organic Chemistry in 1980 under the supervision of Professor Wilfred Chan and Dr. Basil Burke. While visiting the U.S.A. she died in a tragic automobile accident. Her husband later visited the Department and made a donation to establish an award in commemoration of his wife's love for chemistry.

The Pavelich/Honkan Prize, named in honour of Prof. Michael Pavelich and Dr. Vidya Honkan, is awarded to a student who has the third best academic performance in the Introductory Level Courses CHEM1901/1902 in Chemistry and who is proceeding to Level 2 courses. The awardee should not be in receipt of any other Chemistry Department prize in the year of consideration.

- **The Wilfred Chan Award**

Wilfred Chan completed the requirements for the BSc degree in 1952 and then went on to pursue research under the direction of Prof. Cedric Hassall. He completed his research in 1956 and was the first West Indian to receive the PhD degree at Mona. In 1959 he was appointed Lecturer and began a vigorous research programme and rose through the ranks to become the first West Indian to be promoted to a personal chair (1971). In 1966 the Chemistry Department hosted the first Mona Symposium (on Natural Products Chemistry) with him as its Organizing Secretary.

Prof. Chan later served as Head of the Chemistry Department at Mona from 1972 to 1975. In 1979 he moved to the St. Augustine Campus to boost research efforts in its young Chemistry Department. He retired from St. Augustine in 1997, having served as Head and Dean during his tenure there. Prof. Chan's contributions over the years to natural products chemistry are internationally recognized.

The Wilfred Chan Award was first made in 2000 and is for a student who has the best academic performance in the advanced organic chemistry core courses (i.e. CHEM2201 and CHEM3201) and who is pursuing a major in Chemistry. The awardee should not simultaneously hold any other Chemistry Department prize.

- **The Bert Fraser-Reid Award**

Bertram Fraser-Reid is a synthetic organic chemist who has been recognized worldwide for his work in carbohydrate chemistry and his effort to develop a carbohydrate-based malaria vaccine.

Prof. Fraser-Reid earned his BSc and MSc degrees at Queen's University in Canada and a PhD at the University of Alberta in 1964 before doing post-doctoral work with Nobel Laureate and Sir Derek Barton from 1964 -1966. In 2007, the Institute of Jamaica awarded the Musgrave Gold Medal to Prof. Fraser-Reid for his outstanding work in Chemistry. Apart from his interests in science, Prof. Fraser-Reid is an accomplished musician who has given piano and organ recitals at several notable venues.

The Bert Fraser-Reid Award is given to a student with the second best academic performance in the CHEM2201 and CHEM3201 courses. The awardee should not simultaneously hold any other Chemistry Department prize.

- **The Cedric Hassall Scholarship**

The Cedric Hassall Prize was awarded in the past to a student in Chemistry who in the opinion of the Examiners has shown the best performance in the Examinations associated with the first year of advanced Chemistry courses. This prize was recently upgraded to a Scholarship to be awarded to a final year student who is currently majoring in Chemistry and satisfies the above criteria. The prize/scholarship is named in honour of Professor Cedric Hassall, the first Professor of Chemistry at the University and is intended to foster and encourage students to achieve standards of excellence which Professor Hassall insisted should be the hallmark of students pursuing courses in Chemistry. The prize/scholarship was established largely through the instrumentality of Professor Gerald Lalor during his tenure as Head of the Department, and was first awarded in 1971.

- **The Garfield Sadler Award**

Garfield Sadler graduated from the Chemistry Department of the University of the West Indies, Mona, with a degree in Special Chemistry in 1980. He then pursued doctoral studies in Inorganic Chemistry under the supervision of Professor Tara Dasgupta and graduated three years later with a PhD having specialized in the study of Reaction Mechanisms.

In 1983, Dr. Sadler joined the staff of the Department as a Lecturer of Inorganic Chemistry. This marked the start of a vibrant career in teaching and research. His contribution, however, to the development of Chemistry was short-lived as he died tragically in 1991.

The Garfield Sadler Award, which is a tribute to the life and work of Garfield Sadler, is presented to the student with the best academic performance in the inorganic chemistry core courses CHEM2101 and CHEM3101 and who is pursuing a major in chemistry. The awardee should not simultaneously hold any other Chemistry Department award.

- **The Willard Pinnock Prize**

Willard Pinnock served the Department of Chemistry for more than 29 years and retired as a Senior Lecturer in Physical Chemistry in 2011. He is known for his outstanding contribution to teaching and to student guidance and welfare and has been recognized several times by the Faculty for his high scores on the student assessment surveys. He was the first recipient of the Guardian Life Premium Teaching Award at Mona in the academic year 2003/4 and later that year he also received the Vice Chancellor’s Award for Excellence in Teaching.

A UWI alumnus, he earned both BSc (Chemistry and Physics) and MSc (Atmospheric Physics) degrees from the University of the West Indies and holds a PhD degree in Medical Bio-Physics from the University of Dundee.

The Willard Pinnock Prize is awarded to a Chemistry Major who has the best academic performance in the physical chemistry core courses CHEM2301 and

CHEM3301 and who is pursuing a major in chemistry. The awardee should not simultaneously hold any other Chemistry Department prize.

DEPARTMENT OF COMPUTING

- **The Karl Robinson Award in Computer Science**

The Karl Robinson Award is a tribute to the life and work of the late Karl Robinson who distinguished himself as an invaluable member of the then Department of Mathematics & Computer Science. This award is presented to a final year student with the best academic performance in Computer Science. The winner of this award is the student with the highest average in first year, second year and Semester I of the third year Computer Science courses. In case of a tie, the award will be split equally among the winners.

DEPARTMENT OF GEOGRAPHY AND GEOLOGY

- **The Barry Floyd Prizes**

The Barry Floyd Prizes in Geography were named after the first Head of the Department of Geography at the University of the West Indies, Mona Campus, Dr. Barry Floyd. These prizes are awarded annually to the best First and Second year Geography students

- **The Geological Society of Jamaica Scholarship**

DEPARTMENT OF PHYSICS

- **The Francis Bowen Bursary**

The Francis Bowen Memorial Bursary was established in memory of the late Francis Bowen who was the first Head of the Department of Physics. The award is restricted to students in the Faculty of Science and Technology, Mona Campus, who are committed to the study of Physics on the basis of performance in the P200 Level examinations.

- **Level II - Departmental Prize**

The Department has been awarding prizes for many years to students who do well in the "200" level examinations. The purpose is to reward and encourage, and so only those students who go on to "300" level Physics qualify. It is possible, in any case, that no prize is awarded if no student gains a good enough grade, B+ and better. The *two* (2) students with the highest marks are awarded prizes.

- **The Michael Tharmanahthan Physics Bursary**

Dr. Ponnambalam, a Senior Lecturer in the Department of Physics, made a donation to the Department of Physics in memory of his *late father, Michael Tharmanahthan,* to provide bursaries for students reading Physics at the Mona Campus. The Bursary is intended to ensure that financial need does not stand in the way of academic achievement.

- **The John Lodenquai Prize for Introductory Physics**

The John Lodenquai Prize has been established by the family of the late Prof. John Lodenquai, a former Professor in Astro-Physics and a graduate of the University of the West Indies. It is to be presented to the student with the best performance in Level I

DEPARTMENT OF MATHEMATICS

- **The Caribbean Actuarial Scholarship**

The Caribbean Actuarial Scholarship was established in memory of Basil L. and Monica G. Virtue by their son-in-law, S. Michael McLaughlin, an actuary who graduated from the University of the West Indies (UWI). This scholarship is intended to be an annual award to UWI actuarial student(s) who demonstrate a strong record of accomplishment, leadership qualities and a commitment to becoming an actuary.

- **The Harold Chan Scholarship**

Dr. Harold Chan, a graduate of this Faculty and a member of the Department of Pathology, Faculty of Medical Sciences, has donated funds for the award of an Annual Scholarship to the best second-year student in Pure Mathematics.

- **The Merville Campbell Prize: Level I and II**

The Merville Campbell Prize was established by the Mathematics and Computer Science Department in 1995 in memory of Merville Campbell who had served the Department of Mathematics for several years. It is given to the student with the best performance in *MATH1140 and MATH1150* and the student with the best performance in Level II Mathematics.

- **The University Lodge /Leslie Robinson Prize**

The Euclid King/Lodge Prize was established by the University Lodge of the West Indies, as a book grant to a Level I student in honour of one of our members, the late Euclid King who was a lecturer. It has also been decided to commemorate another of its members, Professor Leslie Robinson and each year award the grant in memory of Messers King and Robinson alternately. This is given to the best first year student.

DEPARTMENT OF LIFE SCIENCES

- **The Don Skelding's Prize**

Professor Arthur Donald Skelding, D.Sc. was the second Professor of Botany at the University of the West Indies, Mona from 1955 to 1973. When he returned to Jamaica in June 1985 in his capacity as External Examiner for the B.Sc. in Botany, he made a donation to the Botany Department which the then Professor of Botany invested. The interest from that investment is used for an annual prize `to the best student in the **Preliminary Biology.**

- **The Sasikala Potluri Prize**

Dr. Sasikala Potluri joined the then Department of Botany now Life Sciences in 1980. She had served as a Demonstrator, Teaching Assistant and finally a Lecturer, when she resigned in August 2004. Dr. Potluri has contributed significantly to the department teaching programme at all levels with great success as well as providing a thrust in Horticulture and Tissue Culture. The award named in her honor will be presented annually to the student with the best performance in **Seed Plants.**

- **The L.B. Coke Prize in Plant Physiology**

The late Dr. L.B. Coke, former Senior Lecturer and Head of the Department of Botany, taught Plant Physiology for fifteen years. The Department of Botany has instituted the prize in his honour after his sudden death on 31 December, 1990. This prize is awarded every year to the student who obtains highest mark in **Plant Physiology**. This prize is maintained by contributions from the Consultancy Fund of the Botany Department.

- **The Charlotte Goodbody Prize**

Mrs. Charlotte Goodbody was employed as a Teaching Assistant in the Department of Zoology with responsibility for the first year classes (Cell Biology and Animal Diversity). She conducted laboratory classes and occasionally gave lectures. Her fascination with experimental Biology and Zoology made her an invaluable resource to the first year students, demonstrators and lecturers for many years. She retired in 1989 and now lives in Aberdeen with her husband, retired Professor Ivan Goodbody. The award named in her honour, made for the first time in 2011, is a book grant to be given to the best student in the **First year (first semester) courses**.

- **The Avinash Potluri Prize**

The prize has been established by his parents Dr. Devi Prasad and Dr. Sasikala Potluri, former Senior Lecturer and Lecturer respectively in the Department of Life Sciences. This prize is in memory of their late son, who did Animal Diversity during his Undergraduate years at the University and stated it to be a turning point in his life. The student with the best performance in the **First year Animal Diversity** will receive the prize.

- **The Devi Prasad Prize**

Dr. Devi Prasad joined the then Department of Botany, now Life Sciences in October 1979. He was a former Head of the Department of Botany. Dr. Devi Prasad had served the University for 23 years, when he resigned in August 2003 as Senior Lecturer. He has done extensive research in Algal, Physiology, Marine Plants, Natural Products and Water Pollution. The award named in his honor, awarded for the first time in 2007, is to the student with the best performance in the **First year Plant Diversity** course.

- **The Vincent Hugh Wilson McKie Prize in Zoology**

Vincent Hugh Wilson McKie in addition to being a Zoologist was President of the Guild of Undergraduates, Hall Chairman for Taylor Hall, President of the UWI Drama Club, President of the UWI Camera Club and of the Tennis Club while attending the UWI. He achieved excellence as a science teacher and was awarded the Silver Musgrave Medal for his work in (a) the Sciences (b) Education and (c) the Fine Arts. This Award in his honour is based on the results of the examinations taken at the end of Level 2 of the Degree Programme and is given to a student with high grades in the **Level 2 Zoology courses**. The Award is not based on academic excellence alone but also takes into account participation in extra-curricular activities.

- **The Ivan Goodbody Prize**

Professor Ivan Goodbody arrived at the University College of the West Indies in 1955 and began to immediately investigate the marine organisms found in the Kingston Harbour and Port Royal Cays area using the newly established Port Royal Marine Laboratory (PRML) as his base. He was academic coordinator of the PRML and Lecturer for the Marine Biology courses from 1955 – 1964. Professor Goodbody was Head of Department of Zoology (now Life Sciences) from1964 – 1986 and served as Dean of the Faculty from 1975 - 1977. He retired in 1989 and was appointed Emeritus professor in 1991. The award named in his honour, made for the first time in 2011, is to the best second year student majoring in **Marine Biology**.

GLOSSARY

- **Anti-requisites** – Two mutually exclusive courses of which credit may be granted for only one.

- **Co-requisite** – A course which must be taken along with another specified course, in order to ensure the attainment of complementary and/or interdependent competencies.

- **Course** – A body of knowledge circumscribed by a syllabus to be imparted to students by sundry teaching methods and usually followed by an examination.

- **Credi**t – A measure of the workload required of students in a course. 1 Credit Hour = 1 hour lecture/tutorial/problem class per week OR 2 hours laboratory session per week, for a Semester.

- **Cumulative GPA** – Grade Point Average obtained by dividing the total grade points earned by the total quality hours for which the student has registered for.

- **Discipline** – A body of knowledge encapsulated in a set of courses distinguishable from other such bodies on the basis of criteria such as method of enquiry, axioms, areas of application.

- **Elective** – A course within a programme taken by free choice of the student.

- **Faculty Courses** – All approved courses offered by a Faculty of the University for credit towards a degree, except Foundation and Co-curricular courses.

- **In-Faculty** – All Faculty courses originating in the Science Faculties.

- **Level** – A measure of the standard of a course, designated at UWI by the first digit in the course number.

- **Major** – 32 or more credits from prescribed courses at Levels 2 & 3 (Departmental course listings).

- **Marginal** – A score for the overall examination of a course which is Failure not more than 5 marks below the minimum pass mark for that course.

- **Minor** – 16 credits (15-16 in Agriculture) including prescribed courses at Levels 2 & 3 (see Departmental course listings).

- **Option** – A prescribed programme of in-Faculty and, in some cases, Out-of Faculty courses, leading to a specific degree.

- **Out-of-Faculty** – All Faculty courses originating in Faculties other than the Courses Science Faculties.

- **Part** – A stage of a program:
    - Part I (Introductory Stage) - Level 1 and Preliminary courses
    - Part II (Advanced stage) - Level 2 and 3 courses

- **Pre-requisite** – A course which must be passed before another course for which it is required may be pursued.

- **Programme** – A selection of courses (designed to achieve pedagogical goals) the taking of which is governed by certain regulations and the satisfactory completion of which (determined by such regulations) makes a candidate eligible for the award of a degree/diploma/certificate.

- **Programme GPA** – Weighted grade point average used to determine the class of degree. This GPA is computed on the basis of all courses done in the advanced Part of the degree programme, weighted with respect to credits and to earned quality hours.

- **Semester GPA** – Grade point average computed on the basis of all courses done in a semester, without reference to weighting except in terms of credits. (The terms Grade Point, GPA, Quality Hours and Quality Points are defined in the UWI Grade Point Average Regulations Booklet) any period of time excluding courses taken on a Pass/Fail basis, audited courses, courses taken for Preliminary credit, incomplete and in-progress courses.

- **Subject** – An area of study traditionally assigned to the purview of a department.

- **Supplemental** – A re-sit of an examination offered on recommendation of Department and Faculty, to candidates who, having passed course work; have registered a marginal failure in a course. **(Not currently offered at Mona).**

- S**upplementary** – An oral examination offered on recommendation of Department and Faculty, to candidates who have registered a marginal failure in a Level 2 or Level 3 course.