UWI

ST. AUGUSTINE CAMPUS

2013/2014

POSTGRADUATE

FACULTY OF SCIENCE & TECHNOLOGY

REGULATIONS & SYLLABUSES

CONTENTS

MESSAGE FROM THE DEAN

Welcome to the Faculty of Science & Technology (FST), The University of the West Indies, St. Augustine. We are extremely proud and delighted that you have chosen the FST for your post-graduate training. This new Faculty, which partially replaces the former Faculty of Science & Agriculture, has a strong history in research, innovation and development. We offer a range of post-graduate diplomas, M.Sc., M.Phil., and Ph.D. degrees in disciplines such as Mathematics, Physics, Chemistry, Computer Science, Environmental Science, and Biological Sciences.

The FST is the second largest faculty at the St Augustine Campus and also the most diverse in terms of academic programmes offered. In the FST, we have highly qualified and competent academic, administrative, technical and support staff, and many state-of-the-art laboratories. Several of our academic staff are world-renowned, and some of them were actually post-graduate students at the UWI. We recognize that post-graduate students are the lifeblood of research and innovation in our faculty and encourage you to develop new, creative and interesting ideas. We promise to support you in this effort and offer you post-graduate training that is second to none.

The FST consists of five departments: Chemistry, Computing & Information Technology, Life Sciences, Mathematics & Statistics, and Physics. This booklet contains important information on our various post-graduate programmes and courses and we encourage you to become very familiar with it.

The FST provides post-graduate students with an intellectually stimulating atmosphere conducive to development of critical thinking skills and research. For M.Phil. and Ph.D. degrees, apart from being assigned a supervisor or supervisors, we have also established advisory committees. There are also ongoing research seminars by students, staff and visiting scientists; all post graduate students are required to attend these seminars.

On behalf of the staff of the FST, I wish you a very warm welcome and success in your chosen higher degree, either taught or by research. I also wish you an enjoyable stay in our Faculty and hope that you would have a thoroughly satisfying experience and look back on these years as the most stimulating, productive and rewarding time of your life.

Professor Indar Ramnarine
DEAN

PRINCIPAL OFFICERS AND ADMINISTRATIVE STAFF

DEAN

Professor Indar Ramnarine
BSc (UWI), MSc (Wales), MBA (Heriot-Watt), PhD (UWI)
Ext. 84484
Email: indar.ramnarine@sta.uwi.edu

DEPUTY DEANS

Dr. Shirin Haque
BSc, MPhil, PhD (UWI)
Undergraduate Student Matters
Ext. 83123
Email: shirin.haque@sta.uwi.edu

Dr. Donna Comissiong
BSc, MPhil, PhD (Northwestern Univ.)
Outreach
Ext. 83099
Email: donna.comissiong@sta.uwi.edu

Dr. Adesh Ramsubhag
BSc, PhD (UWI)
Graduate Studies and Research
Ext. 83086
Email: adesh.ramsubhag@sta.uwi.edu

SECRETARIAT:

ADMINISTRATIVE OFFICER
Mrs. Indira Ousman
BSc (UWI)
Ext. 84479
Email: indira.ousman@sta.uwi.edu

DEAN'S SECRETARY
Mrs. Wendy-Ann Wellington
Ext. 84481
Email:wendyanne.wellington@sta.uwi.edu

SECRETARY
Mrs. Laneta Teemal
BSc (UWI)
Ext. 84480
Email: laneta.teemal@sta.uwi.edu

ACCOUNTING ASSISTANT
Mrs. Claire Licorish
BSc (UWI)
Ext. 84477
Email: claire.licorish@sta.uwi.edu

STUDENT SERVICES, SUPPORT & DEVELOPMENT UNIT:

ADMINISTRATIVE ASSISTANT
Mrs. Tara Sookhoo
BSc (UWI)
Ext. 84483
Email: tara.sookhoo@sta.uwi.edu

ADMINISTRATIVE ASSISTANT
Mrs. Laura Rambaran-Seepersad
BSc, MBA (UWI)
Email: laura.rambaran-seepersad@sta.uwi.edu

SECRETARY
Ms. Kereen Olivier
BSc, MSc (UWI)
Ext. 84478
Email: kereen.olivier@sta.uwi.edu

CLERICAL ASSISTANT
Mrs. Sue-Ann Lee Willock
Ext. 84478
Email: sue-ann.lee@sta.uwi.edu

INFORMATION COMMUNICATION MANAGEMENT UNIT:

LAN ADMINISTRATOR
Mr. Krishna Ramdass
BSc Gen., Dip. Ed (UWI). MSc (Portsmouth University)
Ext. 84482
Email: krishna.ramdass@sta.uwi.edu

PC NETWORK SUPPORT TECHNICIAN
Mr. Sean Meloney
BComm, MSc (UWI)
Ext. 84482
Email: sean.melony@sta.uwi.edu

FACILITIES SUPPORT UNIT

FACILITIES MAINTENANCE TECHNICIAN
Mr. Glen Byer
Email: glen.byer@sta.uwi.edu

FACILITIIES ATTENDANTS
(to be announced)

NATIONAL HERBARIUM OF TRINIDAD AND TOBAGO

2nd Floor, Frank Stockdale Building
Tel: (868) 662-2002 Ext. 83326
Tel: (Direct Line) (868) 645-3509
Fax: (868) 663-9686
Email: herbarium@sta.uwi.edu

CURATOR
Mrs. Yasmin Baksh-Comeau (on Sabbatical Leave)
Ext. 83326
Email: yasmin.baksh-comeau@sta.uwi.edu

Mrs. Prudence Coelho-Roberts
Ext. 83326
Email: prudence.roberts@sta.uwi.edu

Mr. Winston Johnson
Ext. 83326
Email: Winston.johnson@sta.uwi.edu

GRAPHITE PROJECT UNIT

Gordon Street, St. Augustine
Tel :(868) 645-9067• Fax :(868) 663-9686
Email: fsa@sta.uwi.edu

TECHNICAL OFFICER
Mr. Nizam Mohammed
Tel: (868) 645-9067

GENERAL INFORMATION ON POSTGRADUATE STUDIES IN THE FACULTY

1. SCHOOL FOR GRADUATE STUDIES AND RESEARCH (SGS&R)

The School for Graduate Studies and Research has the overall responsibility for the development of graduate studies and research on all four campuses of The University of the West Indies. The School is chaired by its Pro Vice Chancellor (PVC, Graduate Studies) and is governed by the Board for Graduate Studies and Research. There is a committee of the SGS&R on each campus called the Campus Committee for Graduate Studies and Research. The SGS&R works closely through these four (4) Campus Committees to manage and administer activities related to research and graduate studies. The School assists academic departments with the maintenance and development of coherent graduate studies programmes and, through the Board for Graduate Studies and Research, approves the establishment of new postgraduate programmes and the award of degrees.

2. TYPES OF GRADUATE PROGRAMMES OFFERED IN THE FACULTY OF SCIENCE AND TECHNOLOGY.

The Faculty offers a wide range of certificates, diplomas, taught Master's degree as well as research degrees (MPhil and PhD)

(a) **Taught Programmes**
The programmes for the Master of Science (MSc) degrees and for Postgraduate Diplomas consist mainly of a set of lectures, seminars, coursework assignments and either a project or a research paper. The Faculty also offers Diplomas and Certificates by distance.

(b) (i) **Research Degrees**
The Master of Philosophy (MPhil) and the Doctor of Philosophy (PhD) degrees are research degrees that primarily involve independent study, directed by one or more supervisors. All MPhil and PhD programmes of study culminate in the presentation of a thesis conveying the results of the independent study and research carried out by the graduate student. It is necessary that graduate students, supervisors, advisory committees and examiners ensure that the qualitative and quantitative distinction between the MPhil Degree and PhD Degree be understood and maintained.

(ii) The MPhil Thesis

The MPhil thesis reviews the state of knowledge in a particular field, creates and evaluates a new design or novel experiments in a particular aspect of an area of study or makes an appropriate critique or interpretation of the subject. The Master's thesis should be evidence of the graduate student's ability to effectively review the relevant literature in the field, to undertake independent research and to present the results in a clear, systematic and scholarly form.

It is normally expected that a Master's thesis will make some independent contribution to knowledge or understanding in the subject area in which the student is working.

(iii) The Doctoral Thesis

A Doctoral thesis must set forth a significant contribution to knowledge or understanding, adding to or critiquing through approved research methodologies the current theoretical underpinnings and empirical base in the student's field of study.

The thesis must be set forth in a scholarly manner demonstrating the original and independent investigations conducted and setting forth unambiguously its achievements, contributions and findings in a format appropriate to Doctoral Theses in the particular discipline.

The Doctoral Thesis must reflect not only mastery of the subject area under investigation and competence in research techniques, but also the ability to select an important problem for investigation and to deal with it in a mature, competent manner.

The Doctoral Degree is, by nature and tradition, the highest certificate of membership in the academic community. It is meant to indicate the presence of superior qualities of mind, intellectual interest and high attainment and knowledge in a chosen field. It is not conferred merely as a certificate for a prescribed course of study and research, no matter how faithfully pursued. Independent achievement at a high intellectual level is a prerequisite to its conferment. A Doctoral Thesis or parts thereof must be judged to be potentially publishable.

The award of a PhD also requires the candidate to defend his/her thesis at a public oral examination. Many research degrees now contain a taught element. The intention of these taught courses is to provide students with research techniques and skills that will not only help them complete their current research topic, but will also stand them in good stead for life after University.

With the exception of holders of MPhil degrees from recognised Universities, candidates interested in pursuing the PhD degree are normally required to register for the MPhil Degree in the first instance. If your Supervisors are happy with your progress, then provisions exist to upgrade your registration from the Master's to Doctoral level without first submitting a Master's dissertation.

If you decide to pursue a research degree, it is very important that the thesis topic you choose is of genuine and sustainable interest to you.

3. REGISTRATION

The academic year is divided into two (2) semesters as follows:
Semester I - August to December
Semester II - January to May

Candidates for the MPhil or PhD degree may register during the first two weeks of either Semester but it is more usual for such candidates to begin their studies at the start of the academic year. A candidate wishing to pursue a taught Master's Degree or an Advanced Diploma programme MUST begin his/her studies at the start of the academic year unless otherwise specified.

Students from Trinidad & Tobago may be registered for full-time or part-time studies. You will not be registered for full-time studies if you spend an average of twelve or more hours a week in paid employment. For a student registering as part-time, proof of leave of absence from your job must be submitted at the time of registration. Overseas students will normally be required to register as full-time studies.

No allowances will be made with respect to attendance at lectures, laboratories, tutorials or examinations for students on the condition of their employment.

4. TIME LIMITATION

The following table shows IN GENERAL the time limitation (in years) for postgraduate degrees:

PROGRAMME	FULL TIME		PART TIME	
	Minimum	Maximum	Minimum	Maximum
Diplomas	1		2	
MSc (taught)	1	2	2	4
MPhil	2	3		5
PhD	3	5	5	7

5. ACADEMIC SUPERVISOR

Each research student is assigned one or more supervisors who will guide the student through his/her studies. The appointment of a supervisor(s) is recommended by the relevant Head of Department after careful consideration of the Faculty member's expertise and experience. Also, a Committee of Advisors shall be appointed by the Board for Graduate Studies and Research for each MPhil and PhD student. This Committee shall comprise a minimum of three persons, including the supervisor(s) of your research programme.

6. ASSESSMENT

a. Taught Programmes

The methods of assessment may vary, but examinations are conducted mainly by written papers supplemented by in-course testing, practical examinations, a project report, a research paper, or a combination of these methods.

Candidates are required to pass all courses and all coursework, designated by the Department as forming part of the higher degree programme for which they are registered, with a mark of 50% or better.

b. MPhil/ PhD Thesis and Examination

All research degrees are examined by theses. In addition, research students will be required to pass courses amounting to a MINIMUM of 6 credits for the MPhil and 9 credits for the PhD degree. For the MPhil degree the candidate may be required to defend his/her thesis by an examination. Every candidate for the PhD must defend his/her thesis by an oral examination.

A candidate who is unsuccessful in the examination for the PhD may apply to the Board for Graduate Studies and Research for transfer of registration to the relevant MPhil and for permission to resubmit the relevant thesis or a revised version of it for examination for a Master's degree. Where the application is approved, the registration for the PhD will lapse and the registration for the MPhil will be deemed to have started from the date of registration for the PhD.

7. UPGRADING OF REGISTRATION

Postgraduate students who are registered for the MPhil degree and who wish to be considered for the upgrading of their registration to PhD must apply to do so in the second year of registration on the written recommendation of their supervisor(s). Applications for upgrading will normally not be considered after the third year of registration. A supervisor must state why he/she considers the student to be outstanding and whether in his/her opinion the work can be developed to the level of the PhD. Applicants for upgrade must submit a written proposal outlining the work done to date and how they propose to develop this work into a PhD and must defend their proposal for upgrading at an open seminar convened for this purpose.

All recommendations from Departments for PhD upgrade registrations are subject to the approval of the Board for Graduate Studies and Research.

8. GRADUATE RESEARCH SEMINARS:

All postgraduate research students are required to present seminars as follows:

- MPhil - at least two
- PhD - at least three

These seminars will be examined and graded on a 'pass' or 'fail' basis. Students are also required to attend a minimum of 75% of all Departmental/Faculty seminars. A Seminar attendance register will be kept by all Departments.

9. POSTGRADUATE COURSE IN "SCIENTIFIC PRESENTATION AND CRITIQUE"

Purpose of the Courses

These courses are designed for MPhil and PhD students for the following purposes:

- Immerse graduate students into a culture of reading and critical analysis of research in their field and related disciplines.
- Expose students to a broad range of research topics in and related to their discipline.
- Involve students in regular scientific discourse involving their own work and the work of others.
- Develop students' analytical and critical thinking skills as well as their oral presentation and writing skills.

NOTE: The School for Graduate Studies and Research state that MPhil students are required to present two assessed seminars and PhD students must present three. These courses may be used as a forum for these presentations which will be assessed in the manner prescribed for such "assessed seminars".

MPhil

GRSM 7004 - Scientific Presentation and Critique 1
GRSM 7005 - Scientific Presentation and Critique 2
GRSM 7006 - Scientific Presentation and Critique 3

PhD

GRSM 8004 - Scientific Presentation and Critique 1
GRSM 8005 - Scientific Presentation and Critique 2
GRSM 8006 - Scientific Presentation and Critique 3

GENERAL INFORMATION ON THE FACULTY OF SCIENCE & TECHNOLOGY

PROGRAMMES

The Faculty of Science and Technology offers training at the graduate level in the Life and Physical Sciences with a wide range of practical and business applications from Environmental Sciences and Management to Information Technology, Computational Mathematics, Material Science, Molecular Biology, Alternative Energy, Medical Physics and Natural Products to name a few. A number of these programmes are multidisciplinary in nature and are done in conjunction with other Departments/Faculties. This training allows students to acquire the range of marketable skills essential in the light of globalisation. Postgraduate programmes in the following areas are currently offered.

POSTGRADUATE DIPLOMA:
Biodiversity Conservation and Sustainable Development in the Caribbean (Offered by Distance Teaching)

MASTER OF SCIENCE (MSc) DEGREES:
- Computer Science
- Mathematics
- Statistics
- Occupational and Environmental Safety and Health
- Biodiversity Conservation and Sustainable Development In the Caribbean (Offered by Distance Teaching)
- Renewable Energy Technology

MASTER OF PHILOSOPHY (MPhil) AND DOCTOR OF PHILOSOPHY (PhD) DEGREES:
- Biochemistry
- Chemistry
- Computer Science
- Environmental Biology
- Mathematics
- Microbiology
- Physics
- Plant Science
- Statistics
- Zoology

ENTRY REQUIREMENTS

Candidates seeking entry to the Diploma, or MSc, or MPhil programmes in the Faculty must satisfy the minimum requirements of the Board for Graduate Studies and Research (Lower Second Class Honours for MSc and Upper Second Class Honours or equivalent for MPhil) AND must hold a BSc degree at the prescribed level in Natural Sciences (or an equivalent qualification) from an approved University. In exceptional cases, students may be admitted with a pass degree and considerable work experience in a related area.

For direct entry into the PhD programme, a student must satisfy minimum entry requirements of the Board of Graduate Studies & Research AND have obtained a MPhil degree (or an equivalent qualification) in an appropriate field of study in science from an approved tertiary level institution.

The Faculty consists of five (5) departments

DEPARTMENT OF CHEMISTRY

MAIN OFFICE
Ground Floor, C3 Building
Tel: (868) 662-2002 Ext. 83570/82091
Tel: (Direct Line) 662-6013
Fax: (868) 645-3771
Email: chemistrydepartment@sta.uwi.edu

STAFF LISTING

HEAD OF DEPARTMENT
Prof. Anderson Maxwell
Ext. 82091
Email: anderson.maxwell@sta.uwi.edu

SENIOR ADMINISTRATIVE ASSISTANT
Mrs. Roxanne Ali-Hassan
BSc (UWI)
Ext. 83785
Email: roxanne.ali-hassan@sta.uwi.edu

SECRETARY (ACTING)
Mrs. Charmaine Joseph-Peters
BSc (UWI)
Tel: 1 (868) 662-2002 Exts. 83570, 82091;
Tel: 1 (868)-662-6013
Fax: (868) 645-3771
Email: charmaine.joseph-peters@sta.uwi.edu
chemistrydepartment@sta.uwi.edu

CLERICAL ASSISTANTS
Ms. Sabrina Ragoo
Ext. 83266
Email: sabrina.ragoo@sta.uwi.edu

Ms. Joan Hernandez
Ext. 82092
Email: ***joan.hernandez@sta.uwi.edu***

OCCUPATIONAL AND ENVIRONMENTAL SAFETY AND HEALTH UNIT COORDINATOR
Ms. Wendy Lawrence
BSc. MPhil (UWI) and MBA (Henley)
Ext. 83268
Email: wendy.lawrence@sta.uwi.edu

ADMINISTRATIVE ASSISTANT
Ms. Tamika Elcock
BSc (Lond)
Ext. 83269
Email: tamika.elcock@sta.uwi.edu

ACADEMIC STAFF/DEVELOPMENT ENGINEERS

D. Beckles
AB (Harvard), MSc, PhD (Rice University)
Lecturer, Environmental Chemistry
Microbial degradation; xenobiotic compounds in aqueous/ non-aqueous systems
Ext. 83534
Email: denise.beckles@sta.uwi.edu

G. Bent
BSc, PhD (UWI)
Lecturer, Analytical Chemistry
Environmental Monitoring and Food Safety
Ext. 83533
Email: grace-anne.bent@sta.uwi.edu

L. Cox
BS (Morgan), MS, PhD (Astate)
Contract Officer III
Research Consulting and Analytical Services
Ext. 84334
Email: leonette.cox@sta.uwi.edu

R. Fairman
BSc, PhD (UWI)
Lecturer, Inorganic Chemistry
Functionalised Macrocylces; Rational Design and Construction of Supramolecular Assemblies
Ext. 82281
Email: richard.fairman@sta.uwi.edu

L. Grierson
BSc, PhD (Lond)
Lecturer, Physical Chemistry
Biophysical Chemistry and Material Sciences
Ext. 83532
Email: lebert.grierson@sta.uwi.edu

N. Jalsa
BSc, PhD (UWI)
Lecturer, Organic Chemistry
Biological Chemistry
Ext. 83546
Email: nigel.jalsa@sta.uwi.edu

N. John-Thomas
BSc (UWI), PhD (Howard)
Lecturer, Chemical Education
Chemical Education - Assessment Teaching and Curriculum Development
Ext. 83270
Email: nicole.john@sta.uwi.edu

F. Julien
BSc Chem Engineering (Hampton)
BSc Electrical Engineering (Ryerson)
Development Engineer - Mass Spectrometry Services
Ext. 84051
Email: franklyn.julien@sta.uwi.edu

A. Kumar
MSc (Gorakhpur); PhD (Tripura)
Lecturer, Inorganic Chemistry
Synthesis and study of inorganic coordinate and organometallic complexes; Dye sensitized solar cells materials
Ext. 83261
Email: arvind.kumar@sta.uwi.edu

W. Lawrence
BSc, MPhil (UWI) and MBA (Henley)
Coordinator, Occupational and Environmental Safety and Health
Ext. 83268
Email: wendy.lawrence@sta.uwi.edu

A. R. Maxwell
BSc, MSc (UWI), PhD (Br. Col)
Professor, Organic Chemistry
Structure Elucidation and Bioactivity of Natural Products; Synthesis of Chiral Catalysts
Ext. 83263
Email: anderson.maxwell@sta.uwi.edu

R. Pingal
BSc, PhD (UWI)
Lab Manager/ Lecturer, Organic Chemistry
Natural products chemistry and biotesting
Ext. 83535
Email: ramish.pingal@sta.uwi.edu

R. Ramsewak
BSc, PhD (UWI)
Lecturer, Organic Chemistry
Structure elucidation of natural products and determination of biological activities.
Ext. 83536
Email: russel.ramsewak@sta.uwi.edu

G. Singh
BSc (Liv.), PhD (Man)
Professor of Chemistry
Organic synthesis; carbohydrate and peptide chemistry
Ext. 83538
Email: gurdial.singh@sta.uwi.edu

N. Singh
BSc, PhD (UWI)
Development Engineer - NMR Services
Ext. 84053
Email: nadia.singh@sta.uwi.edu

D. Stephenson
BA (York), MPhil (CNAA) PhD (Lond)
Senior Lecturer, Physical Chemistry
Nuclear Quadrupole and Nuclear Magnetic Resonance Spectroscopy
Ext. 83260
Email: david.stephenson@sta.uwi.edu

R. Taylor
BSc, PhD (UWI)
Lecturer, Inorganic Materials Chemistry
Materials Chemistry/Liquid Crystals
Ext. 82272
Email: richard.taylor@sta.uwi.edu

A. Wilson
BSc, PhD (UWI)
Lecturer, Physical/Corrosion Chemistry
Electroactive polymers
Ext. 82283
Email: ann.wilson@sta.uwi.edu

W. R. Chan
BSc, MSc, (Lond-UCWI), PhD (Lond)
Professor Emeritus
Extraction and structure elucidation of natural products
Email: wilfred.chan@sta.uwi.edu

B. S. Mootoo
BSc (Lond-UCWI), MSc (Lond), PhD (UWI)
Professor Emeritus
Extraction and structure elucidation of natural products
Ext. 83873
Email: baldwin.mootoo@sta.uwi.edu

A. Pelter
BSc, PhD, D.Sc. (Brist)
Honorary Professor
Organic Synthesis

C. E. Seaforth
BSc (Lond-UCWI), PhD (Wales)
Honorary Lecturer
Extraction and structure elucidation of natural products

PROGRAMMES

MSc/ MPhil/PhD

The Department of Chemistry offers one taught master's programme leading to the MSc in Occupational and Environmental Health and Safety, as well as MPhil and PhD degrees by research in the areas of Natural Products, Inorganic and Materials Chemistry, Liquid Crystals, Environmental Chemistry and Waste Management, Bio-analytical Chemistry, Nuclear Magnetic and Nuclear Quadrupole Resonance Spectroscopy, Supramolecular Chemistry, Organic Synthesis, Microcalorimetric studies on Biological Systems; Corrosion Chemistry and Chemical Education.

Students may register on a part-time or full-time basis. The Board for Graduate Studies and Research offers a limited number of scholarships to students of the highest academic standing registering for MPhil/ PhD Some Departmental funding, in the form of full-time demonstratorships, is available for registered MPhil/ PhD students not on scholarship.

RESEARCH INTERESTS

Topics which are currently being actively investigated by staff include:

- isolation and structure elucidation of Natural Products from terrestrial plants and marine organisms including synthesis and bioactivity testing;
- optical, electronic, magnetic and catalytic properties of organometallic complexes;
- solar cell materials;
- perfluorated phosphine based catalysts;
- rational design and construction of supramolecular assemblies;
- environmental monitoring and hazardous waste management and disposal;
- food safety;
- biosensors for environmental clinical and forensic applications;
- applications of immobilised enzymes and biomolecules, bioseparation processes;
- nuclear magnetic and quadrupole resonance studies of dynamic equilibria;
- calorimetric studies on biological systems;
- the preparation of carbohydrates and novel boron-based catalysts for organic synthesis;
- hydration processes in cement admixtures;
- investigation of aggregate structures in biological membrane models;
- virgin and waste polymer cracking in a fluidised-bed reactor
- synthesis of chiral ligands based on the [2.2] paracyclophane framework for use in chiral synthesis;
- microbial degradation and fate of xenobiotics in environmental systems;
- air quality monitoring
- endocrine disruptors in freshwater systems;
- corrosion chemistry;
- electroanalytical methods;
- carbohydrate synthesis;
- biological/biophysical chemistry;
- oxidation of methane;
- peptide chemistry;
- enzymes in ionic liquids;
- thermotropic phase behaviour of metal containing liquid crystal compounds;
- chemical education - assessment teaching and curriculum development.

FACILITIES

The Department is well-equipped with laboratory space, computer facilities, and instrumentation to support research programmes. Instruments include:

- Gas, Liquid and Droplet Countercurrent Chromatographs;
- Setaram Modular TGA/DSC/DTA/TMA (up to 1700oC);
- Setaram micro DSC III microcalorimeter (with batch and continuous flow cells, heat capacity and flow mix cells);
- Two (2) Gamry high sensitivity modular electrochemical workstations for electrochemical and corrosion measurements;
- Home-constructed Taylor-Aris equipment for diffusion measurements;
- Inert Atmosphere Glove Box;
- Bruker 300, 400 and 600 (cryoprobe) NMR spectrometers;
- FTIR (ATR), Diode-Array, and UV-VIS Spectrometers;
- Nuclear Quadrupole Double Resonance Spectrometer;
- GC- and LC-/Electron spray ionisation (ESI)-Time of Flight Mass Spectrometers;
- Rapid Stopped-flow Kinetic Spectrometer
- Perkin-Elmer Fluorescence Spectrometer
- Perkin-Elmer Inductively Coupled Plasma Mass Spectrometer
- Jasco Model J-720 Spectropolarimeter;
- Veeco Multimode V Atomic Force Microscope/Scanning Electrochemical Microscope
- Linux cluster parallel supercomputer with GROMACS and GAUSSIAN and computational software
- KSV Langmuir-Blodgett apparatus

MSc in Occupational and Environmental Safety and Health (OESH)

Recent developments in areas such as legislation, global trade and rapidly changing technology, have placed new expectations and demands of occupational and environmental safety and health on governments, environmental management, business enterprises, educational institutions, trade unions, workers and the public. Within this scenario, there is an urgent and growing need for the development of a cadre of professionals with competencies in Occupational and Environmental Safety and Health (OESH). Developed in 2005 in Mona, Jamaica, UWI's OESH Programme addresses the growing requirement for all employers, managers, supervisors, policy makers and public leaders to have a functional awareness of the key issues related to environmental and occupational safety and health. The Master of Science in Occupational and Environmental Safety and Health commenced at the St. Augustine campus in September 2009.

Objectives

The Master's programme is designed to prepare persons to function in key areas such as:
Enforcement - to ensure compliance, research and development, training, organisational systems and practice, policy and standards development.

Graduates would be able to develop, design, implement and manage complex OESH programmes and systems and to provide consultancy services and to educate others.

Entry Requirements

Applicants must have either a first degree or its equivalent in basic or applied sciences; candidates with any other BSc degree or equivalent with suitable work experience will also be considered.

Delivery Mode

Intense, modular face-to-face sessions conducted on weekends and holidays, a few weekdays (when foreign lecturers are involved) and agreed evenings. Full-time practitioners in the OESH field are especially encouraged to apply.

The programme will be delivered by international, regional and local lecturers.

Course of Study

For the MSc in OESH, students are required to complete 34 credits of core courses and a research project of 9 credits as outlined below. Each 4 credit course consists of 48 hours of lectures and field visits and/or laboratory work where applicable. Full-time students will normally require 18 months and part-time students three years to complete the programme requirements. The full-time programme will normally consists of two semesters of coursework and examinations followed by the research project while the part-time programme involves four semesters of coursework and examinations followed by the research project.

Course Assessment

This involves coursework, in-course tests and a three (3) hour written examination paper at the end of each semester.

Course Listing

Year I

Semester 1 (17 Credits)

Course Code	Course Title	Credits
OESH 6100	Advanced Environmental Health	4
OESH 6200	Advanced Occupational Safety and Health	4
OESH 6000	OESH and Public Policy	4
OESH 6600	Independent Study and Research Method	4
OESH 6300	Seminar	1

Semester 2 (17 Credits)

Course Code	Course Title	Credits
OESH 6030	Advanced Topics in OESH: OESH Disorders	4
OESH 6010	Advanced Topics in OESH: Measurement methods and Ventilation	4
OESH 6040	Advanced OESH Management Systems	4
OESH 6050	Advanced Topics in OESH: Ergonomics	4
OESH 6300	Seminar	1

Year II

Course Code	Course Title	Credits
OESH 6700	Research Project	9

COURSE DESCRIPTIONS

SEMESTER: 1
COURSE CODE: OESH 6000
COURSE TITLE: OESH AND PUBLIC POLICY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Understanding of the complex, dynamic and delicate relationship between business pursuits, public interests and public policy. For example, fundamentals of public policy-definition, goals and objectives of public policies (regulations, legislation). People, policy agenda, policy institutions, policy formulations, policy implementation and evaluation
Assessment:

Coursework and in-course tests		50%
Final Examination	One 2 hour written paper	50%

SEMESTER: 2
COURSE CODE: OESH 6010
COURSE TITLE: ADVANCED TOPICS IN OESH: MEASUREMENT METHODS AND VENTILATION
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Respiratory system; Dermal exposure; Threshold limit vales and permissible exposure limits; Instruments/equipment used in OESH, including outdoor indoor (air, dust), workplace (air, skin), source emission (both stationary and mobile sources) and noise pollution measuring techniques, in both real-time and with time-integration; Environmental and personal exposure measurements; Calibration, service and preventive maintenance; Survey preparations and performance; Field and Laboratory Analytical Methods practices; Laboratory accreditation; Certification of analysts (biological, chemical and physical measurements); General principles of ventilation, including principles of air flow, duct losses, acceleration of air and hood losses and exhaust systems; Dilution ventilation principles including dilution ventilation for; health, fire and explosion and mixtures; Exhaust Hoods-capture velocity, worker position effect and hood design factors; Air cleaning devices; Principles of exhaust system design; Acute heat disorders.
Assessment:

Coursework	Personal and area sampling in the field, written reports:	50%
Final Examination	One 3 hour written paper	50%

SEMESTER: 2
COURSE CODE: OESH 6030
COURSE TITLE: ADVANCED TOPICS IN OESH: OESH DISORDERS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Understanding of advanced concepts of occupational safety and hygiene. For example, Chemical hazards in industries; Hazardous substances in industries and their target organs; Respiratory disorders-pneumoconiosis; chronic obstructive pulmonary disease; Occupational Illness vs. Work-Related; HIV/Aids as a work place issue; ILO Code of Practice on HIV/Aids and the world of work; Policy and legislation for impacting HIV/Aids in the workplace; ILO Conventions (Health and Safety).
Assessment:

Coursework	Written reports	50%
Final Examination	One 3 hour written paper	50%

SEMESTER: 2
COURSE CODE: OESH 6040
COURSE TITLE: ADVANCED OESH MANAGEMENT SYSTEM
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Advanced exposure Assessment techniques, including self Assessment of exposure; Exposure Assessment strategies and models, such as control banding; Delivery of occupational and environmental health services; Global warming and trans-boundary pollution transport; Hazardous waste management; Management of air quality and water resources; Basic land-use planning; Occupational and environmental audit systems; Disaster management.
Assessment:

Coursework	Laboratory reports and in-course tests	50%
Final Examination	One 2 hour written paper	50%

SEMESTER: 2
COURSE CODE: OESH 6050
COURSE TITLE: ADVANCED TOPICS IN OESH: ERGONOMICS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Advanced understanding of Ergonomics. For example, Work-Related Musculoskeletal Disorders; Evaluating Ergonomic Risk Factors; Application of Ergonomics to design of work space and tools; Office Ergonomics.
Assessment:

Coursework	In course test and field work with written reports	50%
Final Examination	One 3 hour written paper	50%

SEMESTER: 1
COURSE CODE: OESH 6100
COURSE TITLE: ADVANCED ENVIRONMENTAL HEALTH
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Advanced understanding of concepts and issues of environmental health. For example, Environmental toxicology and risk assessment; Population dynamics and geographical information systems; Environmental hazards; Indoor air quality; Ambient air quality; Soil pollution; Water pollution; Sanitation and wastewater treatment; Solid waste disposal and mining pollution; Environmental noise; Emissions control technologies for air; Environmental auditing and impact assessments; Environmental impact of tourism; National and regional guidelines, standards and regulations; International guidelines, standards and regulations;
Assessment:

Coursework	Laboratory and field studies	50%
Final Examination	One 2 hour written paper	50%

SEMESTER: 1
COURSE CODE: OESH 6200
COURSE TITLE: ADVANCED OCCUPATIONAL SAFETY AND HEALTH
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Develop a deep understanding of advanced concepts of occupational safety and hygiene. For example, OSH professionals and the resources available to assist them; contemporary methods of toxicology and risk assessment of workplace hazards; contemporary issues on chemical hazards in the workplace; measurement of chemical hazards in the workplace; measurement of physical hazards in the workplace; ergonomics; occupational epidemiology; national and regional guidelines, standards and regulations International guidelines, standards and regulations
Assessment:

Coursework	Laboratory	20%
	Field survey and report	30%
Final Examination	One 2 hour written paper	50%

SEMESTER: 1 AND 2
COURSE CODE: OESH 6300
COURSE TITLE: SEMINAR
NUMBER OF CREDITS: 1
PREREQUISITE: NONE
COURSE DESCRIPTION: Students will attend seminars or technical presentation once a week and will be required to prepare and make presentations once per semester.

SEMESTER: 1
COURSE CODE: OESH 6600
COURSE TITLE: INDEPENDENT STUDY AND RESEARCH METHODS IN OESH
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: OESH area to be chosen in consultation with a supervisor; study must be on current issues and phenomena in OESH and is designed to prepare students for a productive research Project. Learning activities include: Critical and extensive literature review, use of library and electronic sources of information; Definition of a research question; Research goals and objectives, anticipated results of study and their significance; Research methodologies and ethics, including instrumentation where applicable; Results and their interpretation, discussion and conclusions; literature cited.
Assessment:

Coursework	Laboratory reports and in-course tests	50%
One research paper		50%

SEMESTER: 1
COURSE CODE: OESH 6700
COURSE TITLE: RESEARCH PROJECT
NUMBER OF CREDITS: 9
PREREQUISITE: OESH 6600 OR EQUIVALENT
COURSE DESCRIPTION: This involves an independent research programme supervised by academic staff members. OESH areas are to be chosen in consultation with a supervisor; study must be on current issues and phenomena in OESH; project designed to prepare students for productive research.

POSTGRADUATE RESEARCH PROGRAMME

Every MPhil/PhD student is required to pursue a minimum of two 4 credit courses. One of these is a general course for all students called introduction to Research Techniques in Chemistry (CHEM 6560) and the other course is one in the student's area of interest. In addition, each MPhil or PhD student is required to register for graduate research seminars two for the MPhil (GRSM 7001 and GRSM 7002) and three for the PhD (GRSM 8001, GRSM 8002 and GRSM 8003).

The list of courses (4 credits each) offered by Chemistry Department for MPhil/PhD students :

Course Code	Course Title
CHEM 6160	Metal - Organic Chemistry
CHEM 6161	Physico-Chemical Properties of Inorganic Complexes
CHEM 6260	Advanced Topics in Spectroscopy and Organic Synthesis
CHEM 6460	Advanced Topics in Analytical Chemistry
CHEM 6461	Advanced Topics in Bio-analytical Chemistry
CHEM 6560	Introduction to Research Techniques in Chemistry
CHEM 6561	Advanced Topics in Environmental Chemistry
CHEM 6562	Advanced Topics in Polymer Chemistry

COURSE DESCRIPTIONS:

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6160
COURSE TITLE: METAL-ORGANIC CHEMISTRY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Transition metal coordination complexes and their structural motifs;Transition metal mediated organic transformations: Stotichiometric reagents; Catalysts; Carbon-hydrogen bond activation; Training in the use of the NMR Spectrometer: Running of ^{31}P, ^{1}H, ^{13}C and ^{19}F NMR spectra; NMR Spectroscopy in Inorganic Chemistry: Structure Determination of Organometallic Compounds (using NMR and other techniques); Elucidation of Fluxional processes using NMR.
Assessment:

Coursework		100%

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6161
COURSE TITLE: PHYSICO-CHEMICAL PROPERTIES OF INORGANIC COMPLEXES
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Magnetochemistry of Inorganic complexes; the use and applications of nuclear magnetic resonance (NMR) spectroscopy in Inorganic Chemistry; the uses and applications of electronic spectroscopy in Inorganic Chemistry; the uses and applications of fluorescence spectroscopy.
Assessment:

Coursework		100%

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6260
COURSE TITLE: ADVANCED SPECTROSCOPY AND ORGANIC SYNTHESIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: NMR - understanding modern pulse NMR; Mass spectroscopy; IR and UV Spectroscopy; synthesis: retrosynthetic analysis and synthons; reagents for functional group protection and transformation; carbon-carbon bond forming reactions via electrophile/nucleophile (donor/acceptor) reactions, rearrangements, cycloadditions.
Assessment:

Coursework		50%
Final Examination	One 3 hour written paper	50%

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6460
COURSE TITLE: ADVANCED TOPICS IN ANALYTICAL CHEMISTRY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Instrumental Techniques: Flow injection analysis - continuous FIA etc; Atomic Absorption Spectroscopy - Flame, Graphite Furnace etc.; Emission Spectroscopy-ICP, Optical; Gas Chromatography/Mass Spectroscopy; Chemometrics; Statistics: One-Way/Two-way ANVOA; MINITAB; T-test/F-test/Confidence Interval; Geographic Information Systems (GIS): Arch View; Modelling (GWLF); Enviromental Analytical Chemistry: Water/Wastewater Quality Management - Quality parameters and standards; Theory of Water/Wastewater treatment; unit operations and processes; Solid Waste Management; Forest and Soil Conservation; Environment Impact Assessment; Natural Resilience capacity of streams; Streeter and Phelphs model; Laboratory Management: Principles of Quality Assurance of chemical measurement; Guides for establishing a quality assurance programme for analytical chemistry laboratories.
Assessment:

Course Work		15%
Final Examination	One 2 hour written paper	85%

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6461
COURSE TITLE: ADVANCED TOPICS IN BIOANALYTICAL CHEMISTRY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Protein Purification Methods: conventional methods, modern, affinity chromatography; Protein Separation and Quantitation: Electrophoresis, western blott, radial immunodiffusion; Antibodies: structure; purification and storage; labeling, immunoblotting; immunoassays; Enzyme Linded Immunoassay and Radioimmuno Assays Methods For Quantification of Biochemicals; Use of continuous flow systems incorporation bioreactors for the monitoring of analytes; Immobilization of biomolecules; Bioreactor designs; Biosensors; Controlled release of drugs: use of pH sensitive and temperature sensitive polymers, electroactive hydrogels and phospholipids and matrices for controlled release of drugs; release kinetics; Kinetics of Immobilized Enzyme Systems.
Assessment:

Coursework		60%
Final Examination	One 3 hour written paper	40%

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6560
COURSE TITLE: RESEARCH TECHNIQUES IN CHEMISTRY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Chemical Information Sources and Information retrieval; Format and Style of a Report - ACS Style; Operation of basic chemical instrumentation (IR, UV, Polarimeter, NMR, GC and HPLC etc.); Selected Practical Techniques for the Chemistry; Computers in Chemistry - Chemical drawing and modelling package - spreadsheet package, word processing - basic computer literacy, operating in the Windows environment; (Statistical concepts and experiment design; Data treatment; Selected Practical Techniques: Inert atmosphere techniques, purification of solvents and reagents, Analysis of alkyl lithium and organomagnesium, vacuum distillation, cooling baths, crystallization techniques, chromatography: tic, column and HPLC, liq-iiq extraction, sublimation, special reaction techniques: liq Ammonia reactions, hydrogenation, ozonolysis etc.
Assessment:

Coursework	100%

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6561
COURSE TITLE: ADVANCED TOPICS IN ENVIRONMENTAL CHEMISTRY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Introduction to the environment; energy and cycles of energy; matter and cycles of matter; human impact and pollution; analytical techniques in environmental chemistry
Assessment:

Coursework Essays, seminar presentations	40%
Written exam One 3-hour written paper	60%

SEMESTER: 1 AND/OR 2
COURSE CODE: CHEM 6562
COURSE TITLE: ADVANCED TOPICS IN POLYMER CHEMISTRY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Conducting Polymers, electroactive polymers, sol gel and hydrogels; Analytical application of conducting and electroactive and non-conducting polymers.
Assessment:

Course Work	60%
Final Examination One 3 hour written paper	40%

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

2nd Floor, Natural Sciences Building
Tel: (868) 662-2002 Exts. 83080, 83640
Fax: (868) 645-7132
Email: dcit@sta.uwi.edu
Website: http://sta.uwi.edu/fst/dcit/

STAFF LISTING

HEAD OF DEPARTMENT

Dr. Permanand Mohan
BSc (UWI), MSc (Sask), PhD (UWI)
Senior Lecturer, Computer Science
Advanced Learning Technologies, Mobile Learning
Ext. 83101
Email: permanand.mohan@sta.uwi.edu

POSTGRADUATE PROGRAMME COORDINATOR
Dr. Patrick Hosein
Ext. 83501
Email: patrick.hosein@sta.uwi.edu

ADMINISTRATIVE ASSISTANT
Ms. Laila Salma Khan
Ext. 83798
Email: salma.khan@sta.uwi.edu

SECRETARY
Mrs. Stacey Greene-McNeil
BSc (UWI)
Ext. 83080
Email: stacey.greene-mc neil@sta.uwi.edu

CLERICAL ASSISTANTS
Mr. Nirvan Bhagwandeen
Ext. 83640
Email: nirvan.bhagwandeen@sta.uwi.edu

Ms. Niala Ragoo
Ext. 83640
Email: niala.ragoo@sta.uwi.edu

NETWORK SYSTEMS ADMINISTRATOR
Mr. Naresh Seegobin
BSc, Msc (UWI)
Ext. 82299
Email: naresh.seegobin@sta.uwi.edu

PC NETWORK SUPPORT TECHNICIAN
Mr. Garvin Cadogan
BSc (SAM)
Ext. 82299
Email: garvin.cadogan@sta.uwi.edu

SENIOR RESEARCH TECHNICIAN
Mr. Russell Joseph
Ext. 82299
Email: russell.joseph@sta.uwi.edu

SENIOR LABORATORY ASSISTANT
Mr. Chris Sammy
Ext. 82299
Email: chris.sammy@sta.uwi.edu

ACADEMIC STAFF
M. Bernard
BSc, MPhil, PhD, (UWI)
Senior Lecturer, Computer Science
E-Learning, Information Visualization, Data Management, Data Mining
Ext. 83098
Email: margaret.bernard@sta.uwi.edu
Web: http://www2.sta.uwi.edu/~mbernard

A. Borg
BSc (Hons) IT (Malta), PhD (York), CSM
Temporary Lecturer
Embedded and Real-Time Systems, Software Engineering
Email: andrew.borg@sta.uwi.edu

W. Goodridge
BSc, MPhil (UWI), PhD (Dalhousie Univ., Canada)
Lecturer, Computer Science
Computer Networking, Systems Designs, Computer Security and Digital Watermarking, Internet Technologies
Ext. 83948
Email: wayne.goodridge@sta.uwi.edu

M. Hosein (On Sabbatical Leave 2013/2014)
BSc, MPhil. (UWI), PhD (UWI)
Lecturer, Computer Science
Availability in Distributed Systems, Wireless E-Learning, Wireless Applications
Ext. 82300
Email: michael.hosein@sta.uwi.edu

P. Hosein
BSc (EECS), BSc (Math), MSc, EE, PhD (MIT)
Wireless Communications, Network Optimization, Performance Engineering
Senior Lecturer, Computer Science
Ext. 83501
Email: patrick.hosein@sta.uwi.edu

R. Jordan
BSc (UWI), MSc, PhD (Leeds)
Lecturer, Computer Science
Geographic Information Systems
Email: rene.jordan@sta.uwi.edu

N. Kalicharan
BSc, MSc (Br. Col), PhD (UWI),
Senior Lecturer, Computer Science
Programming Aptitude, Educational Testing, Mental Arithmetic
Ext. 83224
Email: noel.kalicharan@sta.uwi.edu

D. Kieu
BSc (Vietnam), MSc (Australia) PhD (Taiwan)
Lecturer, Computer Science
Multimedia Security (Digital Watermarking and Steganography)
Ext. 83872
Email: duc.kieu@sta.uwi.edu

S. Lackan
BSc (UWI), MSc - Informatics (Italy), MSc - Media Informatics (Germany), Assistant Lecturer, Computer Science
Mobile Health, Blended Learning, Computer-supported Ubiquitous Learning and Advanced Technologies in Education
Email: salys.lackan@sta.uwi.edu

P. Mohan
BSc (UWI), MSc (Sask), PhD (UWI)
Senior Lecturer, Computer Science
Advanced Learning Technologies, Mobile Learning
Ext. 83101
Email: permanand.mohan@sta.uwi.edu

A. Nikov (On Sabbatical Leave 2013/2014)
MSc PhD (TU Sofia), Dr. habil. (TU Braunschweig)
Senior Lecturer, Computer Science
User Experience Design, Human Computer Interaction, Usability Engineering, Computational Intelligence Modelling, Emotional User Experience-Personalized
User Experience, Emotion-Oriented eCommerce
Exts. 83117, Usability Lab: 84127
Email: alexander.nikov@sta.uwi.edu
Web: http://www2.sta.uwi.edu/~anikov/

S. Yussuff
BSc (UG), MSc (Surrey), MSc (Lond)
Lecturer, Computer Science
Object-Oriented Programming, Software Engineering
Ext. 83219
Email: sheik.yussuff@sta.uwi.edu

MSC/MPHIL/PHD PROGRAMMES

The Department of Computing and Information Technology offers one taught Master's programme leading to the MSc in Computer Science, as well as MPhil and PhD degrees by research in the areas of E-learning Technologies, Mobile Learning, Distributed Computing, Networking, Artificial Intelligence, Neural Networks, Database Systems, Internet Technologies, Object-Oriented Systems, Information Visualization, Programming Aptitude, Advanced Learning Technologies.

The MPhil and PhD are research degrees awarded on the submission and successful defence of a thesis. Each MPhil/PhD student must do a minimum of 8/9 credits at graduate level. Interested applicants should consult the Head of the Department concerning available research facilities.

Students may register on a part-time or full-time basis. The Board for Graduate Studies and Research offers a limited number of scholarships to students of the highest academic standing registering for MPhil/PhD. Some departmental funding in the form of teaching assistantships and demonstratorships are available for registered MPhil/PhD students not on scholarship.

RESEARCH INTERESTS

The current research in progress or research areas where activities are planned include:

1. **WIRELESS COMMUNICATIONS:**
   - Radio Resource Management for Next Generation Cellular Networks
   - Performance and Capacity Analysis of Wired and Wireless Networks
   - Pricing and QoS for 4G Networks
   - Mobile Apps for monitoring accessibility, retainability and throughput of wireless networks

2. **WIRELESS AND MOBILE COMPUTING**
   - Mobile Software: research is being conducted into its design and application. Educational and other areas, e.g. agriculture, are used as case studies.
   - Enabling technologies include Bluetooth and SMS.

3. **DISTRIBUTED SYSTEMS**
   - The design and performance of Internet based distributed systems, especially those based on pessimistic and optimistic protocols.

4. **ARTIFICIAL INTELLIGENCE**
   - Mainstream High-Performance-Computing for Artificial Intelligence research and applications.
   - Application of Artificial Intelligence to the Resolution of Real World Problems.

5. **e-LEARNING:** Encompassing all aspects of the use of computer technology to facilitate education, particularly Web-based Instructional Systems.
   - Integrating web-based and classroom teaching in Secondary Schools and the Caribbean.
   - Aggregating and sequencing XML Reusable Learning Objects in a peer-to-peer system.
   - Educational Data Mining (Moodle plug-in).
   - Computer Suopported Collaborative Learning.
   - Accessibility for visually impaired.
   - Mobile Application.

6. **DATA MANAGEMENT AND DATAMINING:** particularly applied to agriculture, energy sector, poverty monitoring.
   - Database Systems, Federated Databases, Data Warehousing/Data Mining.

7. **GEOGRAPHIC INFORMATION SYSTEMS**
   - Developing social simulations using multi agent simulations and GIS techniques. This is with a view of further understanding some of the topical issues in the Caribbean, for example, urban planning, crime, and migration patterns in relation to social development policy.

8. **DECISION SUPPORT SYSTEMS AND GEOGRAPHICAL INFORMATION SYSTEMS**
   - Development of theoretical decision models to solve spatial multiple criterion problems.

9. **COMPUTER SECURITY AND WATERMARKING**
   - Developing digital watermarking techniques.

10. **SOFTWARE ENGINEERING**
    - Embedded Systems.
    - Development of timetabling solutions.

11. **USABILITY, PERSONALIZATION AND EMOTIVE DESIGN**
    Research on usability, personalization and emotive (user emotions) design based on modern mathematical models (computational intelligence: fuzzy logic, neural networks, swarm optimization, etc.) is carried out at the Caribbean's first Usability Lag at the Department of Computing and Information Technology. Its multidisciplinary areas are, as follows:
    - User-experience design and development: user-experience design and development of Interactive systems/products/workplaces like websites, eServices, mobile devices, office workplaces.
    - Usability Testing: usability tests In the Caribbean's first Usability Lab for interactive systems/products/workplaces.
    - Personalization: design and development of user-adapted/personalized interactive systems and products.
    - Emotive design: research on user emotions/affect/mood/enjoyability issues in design and development of interfaces/systems/products/workplaces that adaptively and positively appeal to the emotions of the user. use of advanced technologies for recognition of emotion-based on facial expressions, EEG, ECG,

12. MOBILE HEALTH

- Mobile telemedicine for patients suffering from diabetes and cardio-vascular disease in the Caribbean.

POSTGRADUATE COURSES

MSc in Computer Science

Objectives

To develop a comprehensive and advanced knowledge of Computer Science thereby enabling graduates to perform more effectively in the work place as well as enhance their research capability.

Entry Requirements

To be admitted to this programme a candidate should possess a BSc degree in Computer Science or a major in Computer Science or equivalent (minimum GPA 2.0) with a minimum average of B+ (3.0) in any two (2) of the following courses or equivalent.

Course Code	Course Title
COMP 2000	Data Structures
COMP 2500	Object-Oriented Programming
COMP 3000	Design and Analysis of Algorithms
COMP 3100	Operating Systems

Candidates without the above may be considered for entry upon successful completion of qualifying courses.

Examination

Students will be required to pass both the coursework and the written examination. The pass mark is 50%. The grading scheme for graduate degrees is as follows: A 70 - 100%; B+ 60-69%; B 50-59%.In the case of the Research Project, evaluation will be based on the project report.

Award of Degree

To qualify for the award of the degree, candidates must pass all four core courses, four/five elective courses and the Research Project. The degree shall be awarded in two categories - Distinction and Pass. For the award of the degree with distinction, the candidate must have obtained an average mark of 70% or more, across all core courses and elective courses as well as 70% or more in the Research Project. A Candidate failing a course shall be ineligible for the award of distinction.

Prizes

- The Teleios Systems Ltd. prize is awarded to the candidate with: the best MSc Research Project in Computer Science
- Trinidad and Tobago Network Information Centre (TTNIC) prize for the MSc (Computer Science) Graduate with the Highest Overall Examination Average

Course of Study

For the MSc programme in Computer Science, students are required to complete 4 core courses **and** 4/5 elective courses, as follows:

Either

4 elective courses and an 8-credit Research Project (COMP 6000)

OR

5 elective courses and a 4-credit Research Project (COMP 6001)

Full-time students will normally require a minimum of 3 semesters to complete the programme requirements. Part-time students will normally require a minimum of 5 semesters.

CORE COURSES (4 CREDITS EACH)

Course Code	Title
COMP 6150	Distributed Systems
COMP 6300	Advanced Internet Technologies
COMP 6400	Design and Analysis of Algorithms
COMP 6450	Object-Oriented Design and Programming

ELECTIVE COURSES (4 CREDITS EACH)

Course Code	Title
COMP 6104	Advanced Computer Networks
COMP 6105	M-Business and M-Commerce Technologies
COMP 6106	Wireless Communication and Networks
COMP 6200	Theory of Computing
COMP 6350	E-Commerce Systems
COMP 6500	Computer Architecture
COMP 6550	Computer Graphics
COMP 6560	Computer Forensics
COMP 6600	Artificial Intelligence
COMP 6650	Web Usability
COMP 6730	Cryptography
COMP 6750	Internet Security
COMP 6800	Database Systems
COMP 6980	Scientific Computing
COMP 6990	Operations Research

COURSE DESCRIPTIONS

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6104
COURSE TITLE: ADVANCED COMPUTER NETWORKS
NUMBER OF CREDITS: 4
PREREQUISITES: NONE
COURSE DESCRIPTION: Congestion Control mechanisms; ATM traffic management; Internet traffic management; Differentiated and Integrated Services; Internet routing protocols and multicast routing protocols; Resource reservation; Admission Control mechanisms; Compression techniques; Self-similar data traffic; Quality of Service; Virtual Private Networks; GRID Architectures and Services; Security mechanisms and services; Research topics in emerging new technologies.
Assessment

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6105
COURSE TITLE: M-BUSINESS AND M-COMMERCE TECHNOLOGIES
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Mobile Commerce Landscape: Mobile ISP; Mobile devices; Mobile Software platforms; Mobile Application Services; J2ME Architecture and Components; Smart Client paradigm and Managed Smart Clients; Mobile Design Patterns; The Smart Ticket Blueprint; Advanced HTTP techniques; End-To-End Best practices; pervasive devices and ubiquitous integration; Mobile Messaging Applications; Converted MobileP2P Messaging and Enterprise Messaging; Mobile Databases and Synchronization Engines; Mobile Databases for MIDP Devices; Database Synchronization; Access Backend Databases; XML and Mobile Web Services; SOAP WEB Services on Smart Clients; the J2ME Web Services; Advanced Mobile Security; Implementing WAP Services.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: 1
COURSE CODE: COMP 6106
COURSE TITLE: WIRELESS COMMUNICATIONS AND NETWORKS
NUMBER OF CREDITS: 4
PREREQUISITES: NONE
COURSE DESCRIPTION: The fundamentals wireless communications topics; Antennae and Propagation; Signal Encoding Techniques; The Concept of Spread Spectrum; Coding and Error Control; Wireless Networking: Satellite Communications; Cellular Wireless Networks; Cordless Systems and Wireless Local Loop; Mobile IP; Wireless Access Protocol; The Wireless LAN Technologies; Infrared LANS; IEEE 802.11; Wireless LAN Standard, Bluetooth; Wireless Security Mechanisms; Traffic Analysis, Wireless Routing and Resource Allocation Mechanisms; Ad-hoc Networks; Emerging New technologies
Assessment:

Coursework	40%
Final Examination - One 3-hour written paper	60%

SEMESTER: 2
COURSE CODE: COMP 6150
COURSE TITLE: DISTRIBUTED SYSTEMS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Characterization of Distributed Systems. Interprocess Communication. Distributed Objects and Remote Invocation. Operating Systems Support. Distributed File Systems. Name Services. Introduction to Transactions and Concurrency Control. Introduction to Distributed Transactions. Replication. Introduction to a modern middleware package.
Assessment:

Coursework	40%
Final Examination - One 3-hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6200
COURSE TITLE: THEORY OF COMPUTING
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Turing machines: computing with Turing machines, nondeterministic Turing machines, grammars, numerical functions. Undecidability: Universal Turing machines, the halting problem, unsolvable problems, recursive languages Computational Complexity: the class P, the class NP, Boolean satisfiability NP-Completeness: selected examples, Cook's theorem
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: 2
COURSE CODE: COMP 6300
COURSE TITLE: ADVANCED INTERNET TECHNOLOGIES
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: XML and XSL; Document Type Definition; Document Object Model; Special XML-concepts (SAX, XPath, Xlink, Xpointer,Ö); Active Server Pages; Building Web Services; Web Service Description Language.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6350
OURSE TITLE: E-COMMERCE SYSTEMS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Overview of Electronic Commerce (EC) and Electronic Business (EB); Introduction to Internet Business Models; EC and EB Technologies; EC and EB Architectures for Scalable Systems; Business to Consumer Electronic Commerce Systems; Design Templates and Software Components for Typical EC and EB systems; Intranets and the automation of Business to Business Transactions; Key issues and Technologies in EC Security; Developing and Supporting Trust Models on the Internet; Future Directions in EC and EB technologies.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

Details*:* http://www2.sta.uwi.edu/~anikov/comp6350/index.htm (PSW:6350comp)

SEMESTER: 1
COURSE CODE: COMP 6400
COURSE TITLE: DESIGN AND ANALYSIS OF ALGORITHMS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Review and analysis of data structures: stacks, queues, linked lists, hash tables, binary search trees, red-black trees, graphs, spanning trees. Analyze algorithms for time and space bounds. Growth of functions. Asymptotic notation. Recurrences: substitution, iteration, master method. Review and analysis of sorting methods: insertion sort, merge sort, heapsort, quicksort. Algorithm design techniques. Recursive techniques. Backtracking. Dynamic programming. Greedy algorithms. Divide-and-conquer algorithms. Graph algorithms. Network flow. Bipartite matching. String matching algorithms. Approximation algorithms. Examples of problems that can be solved using each of these techniques.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: 1
COURSE CODE: COMP 6450
COURSE TITLE: OBJECT-ORIENTED DESIGN AND PROGRAMMING
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Object-Oriented Principles and Java; UML diagrams Principles of Object-Oriented Design. Detailed Look design patterns. The GOF Design Patterns and applications. Refactoring. The JUNIT Framework and unit testing. Software Engineering, Extreme Programming Design Concepts.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6500
COURSE TITLE: COMPUTER ARCHITECTURE
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Microprocessor Design; Super Computers; Instruction Sets; Microprogramming; Memory Management; Execution Enhancement Techniques; Computer Arithmetic Processors; Multiprocessor Systems.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: 2
COURSE CODE: COMP 6550
COURSE TITLE : COMPUTER GRAPHICS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: This course familiarizes the student with the graphics rendering pipeline, as used in computer games, digital special effects and 3-dimensional hardware for scientific visualization. There is in depth examination of important and frequently used graphics algorithms, ranging from simple primitive rasterization to advanced global illumination shading. Detailed mathematical treatment of common 3D coordinate transforms is given without need of a background in linear algebra. Advanced modeling and animation topics are also discussed. Topics include: Fundamental concepts; Drawing 2D primitives - raster graphics; Geometrical transformations; Viewing transforms; Curves and Surfaces; Object Hierarchy; Colour Spaces; Surface Visibility; Illumination Shading and Realism; Animation and Physically Based Simulation.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6560
COURSE TITLE: COMPUTER FORENSICS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Computer Forensics is the scientific, systematic inspection of a computer system and its contents for evidence or supportive evidence of a crime or other computer misuse. Computer forensics requires specialized expertise that goes beyond normal data collection and preservation techniques available to end-users or system support personnel. This process often involves investigating computer systems to determine whether they are or have been used for illegal or unauthorized activities. Mostly, computer forensics experts investigate data storage devices; these include but are not limited to hard drives, portable data devices such as USB Drives, external drives, micro drives. This course covers the fundamental principles and techniques of forensic science with emphasis on digital evidence. Forensic computer science involves the identification, collection, preservation and analysis of computer evidence stored on various computer storage devices. The course requires advanced knowledge of computer systems, especially the low level details of storage and file systems. It will expose students to the investigative techniques for seizure and forensic examination of computer systems. The teaching/learning approach will be a mix of lectures and labs. Students will gain hands-on practice in networking and forensic tools in the lab sessions.
Assessment:

Coursework	30%
Midterm Exam	20%
Final Examination	50%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6600
COURSE TITLE: ARTIFICIAL INTELLIGENCE
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Topics will be taken from any area of Artificial Intelligence that are relevant to current research activities within the department or which are advanced versions of techniques taught at the undergraduate level. Topics will be taken from, but are not limited to the following: Advanced searchtechniques; Expert systems; Planning; Reasoning; Natural Language Processing; Machine Learning; Embodied cognition.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6650
COURSE TITLE: WEB USABILITY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Web usability has become an essential requirement of web-based systems. A major cause underlying poor web usability is a lack of understanding of a usability engineering process for developing usable web interface designs. Software developers often still have primary responsibility for developing interactive systems, but most are not trained in web usability methods and, therefore, do not have the knowledge and skills to include web usability methods in their life cycle activities. The purpose of this course is to learn about the process of developing web sites. This course will take a user-centered approach to designing web sites and will focus on the entire lifecycle of a web site, from the initial idea of developing a web site, collecting the requirements, designing the pages, performing usability testing, and implementing and managing a web site. It examines the basic design and usability issues for web development. Current platforms and technologies for web applications are presented. The course focuses on usability of web sites in terms of content organization, navigation, page and site design, and the general principles of web usability. Case studies are presented and explain how user-centered design concepts have been applied to web development in real-world situations. During the course the students will work on a group project following the user-centered approach for designing websites.
Assessment:

Coursework (project):	70%
Final Examination - One 2-hour written paper:	30%

Details*:* http://www2.sta.uwi.edu/~anikov/comp6650/index.htm (PSW:6650comp)

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6730
COURSE TITLE: CRYPTOGRAPHY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Classical Cryptography: some simple cryptosystems, cryptanalysis; Shannon's theory: entropy, Huffman encodings; Block ciphers and the Advanced Encryption Standard (AES); Cryptographic Hash functions; The RSA cryptosystem and factoring integers; Signature Schemes; Applications (e.g. Remote Payments with Bank Cards).
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: 1
COURSE CODE: COMP 6750
COURSE TITLE: INTERNET SECURITY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Generic security model: the different levels of security; HTTP security; Proxy Servers and Firewalls; Internet Security protocols; SSL and TLS protocols; Some applications like Electronic Payment.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: 2
COURSE CODE: COMP 6800
COURSE TITLE: DATABASE SYSTEMS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Database Design (UML); Query Processing and Performance Tuning; XML-enabled Databases; Databases and the Internet; Object-Relational Databases; Transaction Management - Concurrency Control and Recovery Management; Data Warehousing; Business Intelligence; OLAP; Data Mining; Distributed Databases; Database Administration; Temporal and Spatial Databases; Text/Document Databases (Content Management Systems).
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6980
COURSE TITLE: SCIENTIFIC COMPUTING
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: This course delivers an introduction to Scientific Computing. It introduces the requisite mathematics and computer science in the course of solving realistic problems. It will be based on the use of Java and Maple. Getting Started with Maple; Numbers, Expressions, Functions; Visualizing Data; Differentiation and Integration; Matrices and Vectors; Web Computing; Scientific Document Processing.
Assessment:

Coursework	100%
No Final Written Examination	

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: COMP 6990
COURSE TITLE: OPERATIONS RESEARCH
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Elements of a Decision Model; Introduction to Linear Programming; The Simplex Method, Sensitivity Analysis; Applications to Transportation and Networks Models; Probability and Statistics Review; Data Presentation and Statistical Techniques, Forecasting; Decision Analysis, Bayes Procedure; Competitive Strategies - Game Theory; Project Management, Scheduling by Pert-CPM; Inventory Models; Stochastic Inventory Models; Waiting lines. Steady-State Measures of Performance.
Assessment:

Coursework	40%
Final Examination - One 3 hour written paper	60%

DEPARTMENT OF LIFE SCIENCES

MAIN OFFICE
Ground Floor Natural Sciences Building
PBX: 1 868 662 2002; Exts. 83095; 83111; 83789; 82045
FAX: 1 868 663 5241; 663-5409

STAFF LISTING

HEAD OF DEPARTMENT
Prof. John B. Agard
Ext. 83095
Email: john.agard@sta.uwi.edu

SENIOR ADMINISTRATIVE ASSISTANT
Mrs. Deborah Alleyne
BSc (UWI)
Ext. 83789
Email: deborah.alleyne@sta.uwi.edu

SECRETARY
Mrs. Casandra James-De Freitas
Ext. 82045
Email: casandra.james@sta.uwi.edu

ACTING SECRETARY
Mrs. Paulette Belfonte-Paul
Ext. 82047
E-mail: paulette.belfonte@sta.uwi.edu

CLERICAL ASSISTANTS
Ms. Leela Jagdeo
Ext. 82045
E-mail: leela.jagdeo@sta.uwi.edu

Ms. Liesha Joseph
Ext. 82080
E-mail: liesha.joseph@sta.uwi.edu

ACCOUNTING ASSISTANT
Ms. Geeta Badloo
Ext. 83788
E-mail: geeta.badloo@sta.uwi.edu

ACADEMIC STAFF
J. B. Agard
BSc (UWI), MSc (Manch.), PhD (UWI)
Professor of Tropical Island Ecology
Social-Ecological systems in development planning; small island biodiversity and ecosystem services; climate change vulnerability impact and adaptation scenarios, carbon sequestration and greenhouse gas emission reduction
Ext. 83095
Email: john.agard@sta.uwi.edu

M. Alkins-Koo
BSc (UWI), MSc (Lond.), PhD (UWI)
Senior Lecturer, Zoology
Freshwater Ecology; The assessment and monitoring of anthropogenic impacts in freshwaters
Ext. 83094
Email: mary.alkins-koo@sta.uwi.edu

Y. S. Baksh-Comeau
BSc, MPhil (UWI)
Curator National Herbarium of T&T;
Systematics of the vascular flora of Trinidad & Tobago including Plant Ecology; Ethnobotany; Phytogeography; Biodiversity & Conservation
Ext. 83326
Email: yasmin.baksh-comeau@sta.uwi.edu

G. F. Barclay
BA (Mt Allison), PhD (Aberdeen)
Lecturer, Plant Sciences
Hormonal control of plant development; Phytoplankton and pollution modeling; Chemistry of greenheart durability
Ext. 83112
Email: gregor.barclay@sta.uwi.edu

V. J. Bowrin
BSc (UWI), PhD (Purdue)
Lecturer, Biochemistry
Pigeon pea flower abscission; Development of a monounsaturated coconut oil
Ext. 82079
Email: valerie.bowrin@sta.uwi.edu

D. D. Chadee
BSc (Dalhousie), MPhil (UWI), PhD, MPH, D.Sc. (Dundee)
Professor, Environmental Health
Ecology and control of parasitic diseases and insect vectors. Climate Change and Public Health Diseases
Ext. 83740
Email: dave.chadee@sta.uwi.edu

B. N. Cockburn
BSc, PhD (UWI)
Senior Lecturer, Biochemistry
Metabolic diseases; Nutritional content of foods;
Genetic diversity of sweet potato
Ext. 83541
Email: brian.cockburn@sta.uwi.edu

E. J. Duncan
BSc (Lond UCWI), PhD (St. Andrews)
Professor Emeritus, Botany
Plant Tissue Culture, Algal Biology, Plant Reproductive Biology
E-mail: julian.duncan@sta.uwi.edu

W. Elibox
BSc, PhD (UWI)
Lecturer, Genetics
Genetic improvement of anthurium, hotpepper, sugarcane, cocoa, tomato through Breeding and Biotechnology
Ext: 83108
E-mail: winston.elibox@sta.uwi.edu

A. Farrell
BSc (Edinburg); P.Dip, PhD (Trinity College, Dublin)
Lecturer, Plant Physiology
Plant Physiology and Ecophysiology, Plant Productivity and response to aboitc stress; Genotype x environment interactions
Ext. 82047
Email: aidan.farrell@sta.uwi.edu

J. Gobin
BSc, MPhil (UWI), PhD (Exeter, UK)
Lecturer, Zoology
Marine Ecology including Benthic Ecology;
Rocky shore fauna & marine invasive species
Ext. 82046
Email: judith.gobin@sta.uwi.edu

A. Hailey(on Sabbatical Leave 2013/2014)
BSc (Lond), PhD (Nottingham)
Senior Lecturer, Zoology
Animal Ecology; Behaviour & Ecophysiology; Herpetology
Ext. 82206
Email: adrian.hailey@sta.uwi.edu

J. Jayaraman
BSc, MSc, PhD (Annamalai)
Senior Lecturer, Microbiology
Plant-Microbe interactions, Induced Resistance, Plant-Metabolic Engineering, Biopharming, Phyto-nutraceuticals, Seaweed products
Ext. 83092
Email: jayaraj.jayaraman@sta.uwi.edu

A. Khan
BSc, PhD (UWI)
Senior Lecturer, Plant Sciences
Integrated Pest Management; Biological Control
Ext. 83087
Email: ayub.khan@sta.uwi.edu

A. Lennon
BSc, D.Phil (Sussex)
Lecturer, Biochemistry
Plant Respiratory Complexes; IMMUTANS and alternative oxidases; flavonoid biosynthesis in anthurium
Ext. 83216
Email: adrian.lennon@sta.uwi.edu

A. Mohammed
BSc, PhD (UWI)
Lecturer, Zoology
Ecotoxicology; Environmental Pollution Chemistry; Carbon sequestration and emissions monitoring
Ext. 82046
Email: azad.mohammed@sta.uwi.edu

H. P. Nelson
BSc, MPhil (UWI), PhD (Wisconsin)
Temporary Lecturer, Zoology
MSc Co-ordinator; Wildlife Biology; Conservation Biology;
Ext. 83739
Email: howard.nelson@sta.uwi.edu

M. P. Oatham
BSc (Western Aust.), PhD (Kent)
Lecturer, Plant Sciences
Forest Ecology and Management
Ext. 83088
Email: mike.oatham@sta.uwi.edu

D.T. Phillip (on Sabbatical Leave 2013/2014)
BSc, MPhil (UWI), PhD (St. Andrews)
Lecturer, Life Sciences
Fisheries Biology And Management; Environmental Microbiology; Coral Reef Ecology, Freshwater Ecology
Ext. 82208
Email: dawn.phillip@sta.uwi.edu

I. W. Ramnarine
BSc (UWI), MSc (Wales), PhD (UWI), MBA (Heriot-Watt)
Professor, Ichthyology Fisheries Biology and Management; Aquaculture; Aquaponics; Fish and Crustacean Biodiversity; Ecology, Behaviour and Evolution of Guppies; Wetlands Ecology
Ext. 83093
Email: indar.ramnarine@sta.uwi.edu

S. Rampersad
BSc, PhD (UWI)
Lecturer, Biochemistry
PR proteins; Plant defense elicitors; Fruit rot disease complex in pumpkins; Vascular wilt in pumpkins
Ext. 83109
Email: sephra.rampersad@sta.uwi.edu

A. Ramsubhag
BSc, PhD (UWI)
Senior Lecturer, Microbiology and Plant Pathology
Biological Nitrogen Fixation; micro-organisms involved in degradation of environmental contaminants; Bioaerosols impacting on indoor air quality; Diseases of tropical crops
Ext. 83086
Email: adesh.ramsubhag@sta.uwi.edu

J. Rouse-Miller
BSc, MPhil PhD (UWI)
Lecturer, Plant Sciences
Plant Tissue Culture; Anatomical and Molecular aspects of pigeon pea abscission
Ext. 83089
Email: judy.rouse-miller@sta.uwi.edu

M. Rutherford
BSc (Glasgow); MSc (James Cook)
Museum Curator
Ext. 82231
Email: mike.rutherford@sta.uwi.edu

C. K. Starr
BA (Carleton), M.A. (Kansas), PhD (Georgia)
Professor, Entomology
Entomology Systematics and Behavioural Ecology of Social Insects, History of Entomology
Ext. 83096
Email: christopher.starr@sta.uwi.edu

P. Umaharan
BSc (Peradeniya), PhD (UWI)
Professor of Genetics
Head, Cocoa Research Centre , UWI)
Transformation of tropical crop species; Genetic analysis of resistance to tropical diseases and resistance breeding; Genetic Diversity and Plant Genetic Resource Management
Exts. 83111/2114
Email: pathmanathan.umaharan@sta.uwi.edu

RESEARCH INTERESTS AND FACILITIES

The Department of Life Sciences specialises in two (2) of the most innovative and dynamic areas of current research and development, namely (a) Small Island Biodiversity and Environmental Management and (b) Biotechnology and Molecular Biology. Research focuses on biodiversity and ecosystem services, conservation biology and natural resources management (e.g. tropical forests, fisheries and aquaculture), pollution impacts and management, climate change vulnerability impact and adaptation. There is also a long history of research and development projects in Biotechnology and Molecular Biology as they relate to agriculture and human wellness. Current research projects use approaches such as Recombinant DNA Technology. Research also focuses on providing new knowledge on the physiology and metabolism of tropical plants in important areas such as tuberisation, abscission and mechanism of resistance to pests and pathogens. Studies in Microbiology and Crop Protection are also important focal areas. In addition to the above, research is ongoing in the traditional disciplines such as Biochemistry, Botany, Zoology, Ecology, Epidemiology and control of diseases of public health importance.

The Department offers graduate programmes leading to MPhil and PhD degrees in all areas of research being pursued by academic staff as outlined above. The Department has supporting specialist research laboratories in Biotechnology and Tissue Culture, Entomology, Environmental Biology, Ecology, Parasitology, Ecotoxicology, Biosystematics, Biochemistry, Histology, Microbiology, and Aquaculture and Fisheries. The Department also maintains the National Herbarium, Zoology Museum, Land Arthropod Collection and several greenhouses.

Applicants to the MPhil or PhD research programme, should liaise with their potential supervisor for guidance in developing a clear research project and research proposal which must be submitted to the Head of Department. Guidelines for the preparation of a research proposal are available at **http://sta.uwi.edu/fsa/lifesciences/documents/researchproposal.pdf**. Supervisors listed in the application form should have agreed to do so.

PROGRAMMES

Diploma/ MSc in Biodiversity Conservation & Sustainable Development in the Caribbean

The online graduate degree in Biodiversity Conservation and Sustainable Development in the Caribbean is a taught programme geared towards building and strengthening capacity in environmental management, biodiversity conservation and sustainable development in the Caribbean. The programme will be offered in two forms, Graduate Diploma and MSc and can be undertaken either on a full time or part time basis. Teaching on this programme will involve a blend of internet-based distance teaching and face-to-face training.

Objectives

The main objective of this graduate degree is to supply the region with qualified professionals who have a comprehensive knowledge of the concepts and principles of a wide range of science and environmental management issues related to tropical biodiversity. Advanced practical skills in environmental monitoring, impact analysis, environmental management, data management and policy issues will be taught in this programme. In addition, a working knowledge and appreciation of the major disciplines within environmental science and a multidisciplinary overview of environmental data collection and analysis together with an acquired and improved range of transferable skills including group work, scientific research, data analysis, report writing and oral presentation, will be provided to learners in this programme. As such it will provide students with a set of skills that will allow them to advance their careers in the environmental management and biodiversity conservation fields within their government, public sector, NGOs and industrial organisations.

Entry Requirements

Candidates applying for admission are required to satisfy the relevant general regulations of the Faculty and the University's Board for Graduate Studies and Research. The prerequisite for entry into the programme is a bachelor's degree in one of the following disciplines: natural sciences, engineering, agricultural sciences, geography, education or an appropriate social sciences from an approved university, with at least lower second-class honours or a minimum GPA 2.0 (or equivalent qualification and work experience).

Duration

Students enrolled in the Diploma Programme will be required to complete the course in either 1 year (full time) or 2 years (part time).

Students enrolled in the MSc Programme will be required to complete the degree in 1½ years (full time) or 3 years (part time).

Modes of Delivery
As a post-graduate Diploma/MSc level course, a variety of methods of delivery will be employed, which include face-to-face interactions, virtual seminars, tutorials, field visits and a research project. This will be supported by distance learning and e-based course assignments as well as project and scenario based workshops, case studies and assignments in which group work and student centred learning approaches are adopted. Thus, increasing onus will be put on the student to take responsibility and control of their own learning. This will lead to the point of the final research project in which the student will be responsible for the development, management and reporting of a study with the supervisor acting as an advisor and facilitator. Additionally, the programme aims to maximise access by professionals working in government, NGO and commercial organisation by supporting face-to-face sessions with distance learning, assignments etc. which students can undertake from their home.

Course Assessment
A variety of course assessment techniques will be utilized throughout the programme.

Research Project
A Research Project is a fundamental component of the MSc programme and this is reflected, not only in the credit weighting, but by the fact that the MSc runs for an extra 6 months so that the student may have the necessary time to complete the project to a high standard.

The aim of the research project is to allow the student to synthesise and articulate several aspects of the taught programme within a single themed research topic. In addition, it will provide the opportunity for further detailed skills training in specific aspects of environmental monitoring, assessment or management of tropical biodiversity. It will allow the student to pursue an individual study on a particular research topic or issue of interest to the student and will incorporate technical skills training specific to the individual student. As such, the research project will provide the opportunity to develop a specific set of practical and reporting skills that will be of use to the student in their future career.

Award of Diploma/Degree
In this joint Diploma/MSc, the main awarding University will be the University delivering the most teaching to the specific student. Thus, prospective students should note that their degree will be awarded based on the number of credits taught by the various partner institutions.

Diploma in Biodiversity Conservation and Sustainable Development in the Caribbean

The Diploma programme consists of 24 credits and students will be required to complete any seven (7) core courses and one (1) of the options in order to successfully complete it. Each course carries 3 credits.

CORE COURSES

Course Code	Title
BIOL5200	Characteristics of Biodiversity
BIOL5201	Threats to Tropical Biodiversity
BIOL5206	Management and Analysis of Environmental Data
BIOL5208	Conservation and Management of Biodiversity
BIOL5210	Field Practicum
BIOL5212	Taxonomy and Biodiversity Informatics
BIOL5214	Environmental Resources Policy

OPTIONS

Course Code	Title
BIOL5202	Environmental Law and Multilateral Environmental Agreements
BIOL5203	Environmental Economics
BIOL5204	Environmental Impact Assessment
BIOL5205	Principles and Practice of Geoinformatics
BIOL5207	Sustainable Use and Management of Natural Resources
BIOL5209	Pollution and Ecotoxicology
BIOL5213	Advanced GIS
BIOL5215	Socio-ecology and Natural Resources Management

MSc in Biodiversity Conservation & Sustainable Development in the Caribbean

The MSc programme consists of 45 credits. Students will be required to complete the following courses:

- Seven 3-credit core courses and one 12-credit Research Project (BIOL 6211)
- Four Optional 3-credit courses

CORE COURSES

Course Code	Title
BIOL6200	Characteristics of Biodiversity
BIOL6201	Threats to Tropical Biodiversity
BIOL6206	Management and Analysis of Environmental Data
BIOL6208	Conservation and Management of Biodiversity
BIOL6210	Field Practicum
BIOL6212	Taxonomy and Biodiversity Informatics
BIOL6214	Environmental Resources Policy
BIOL6211	Research Project

OPTIONS

Course Code	Title
BIOL6202	Environmental Law and Multilateral Environmental Agreements
BIOL6203	Environmental Economics
BIOL6204	Environmental Impact Assessment
BIOL6205	Principles and Practice of Geoinformatics
BIOL6207	Sustainable Use and Management of Natural Resources
BIOL6209	Pollution and Ecotoxicology
BIOL6213	Advanced GIS
BIOL5215	Socio-ecology and Natural Resources Management

COURSE DESCRIPTIONS

SEMESTER: 1
COURSE CODE: BIOL 5200/BIOL 6200
COURSE TITLE: CHARACTERISTICS OF BIODIVERSITY
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course will form part of the background information to the programme. It will include basic concepts of biodiversity from the molecular- to the ecosystem-scale. This will be placed in the context of the extinction crisis and international treaties such as the Convention on Biological Diversity that have been formulated to address this crisis. It will, in particular, highlight the importance of biodiversity in terms of ecosystem function, goods and services. The course will define biodiversity in terms of species richness and diversity indices and explore the cline in diversity across different latitudes. Within this concepts such as endemicity and keystone species will also be described. The molecular genetic component of the course will cover the concepts of molecular genetics, intra-specific variation, inter and intra-specific genetic diversity, processes of evolution and speciation. The course will then go on to describe the regional ecosystems including forest, savannah, riverine, wetland, mangrove and coastal-marine systems including coral reefs. Impacted ecosystems such as urban and agricultural landscapes will also be treated. In each case, these systems will be considered holistically in relation to their diversity, distribution, ecology and ecosystem function, including the goods and services they provide.
Assessment:
Coursework 100%

SEMESTER: 1
COURSE CODE: BIOL 5201/BIOL 6201
COURSE TITLE: THREATS TO TROPICAL BIODIVERSITY
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course will examine the major threats to tropical biodiversity and ecosystems. It will highlight the major threats, as described in the CBD: habitat loss and degradation, over-exploitation, climate change, pollution and introduction of alien species. It will also examine the history of human intervention in tropical environments. In specific relation to loss of genetic diversity, issues including threats to genetic diversity, loss of populations, reductions in heterozygosity and their consequences, inbreeding depression and genetic bottlenecks will be considered. Using examples, and case studies, major threats will be considered in relation to the impacts being seen on some of the ecosystems described in BIOL6100. It will include a description of human altered terrestrial and coastal environments. Consideration will also be given to the issues of environmental stress including impacts of pollution and climate change on terrestrial and marine systems. Evidence for global warming, impacts on species and ecosystems and methods for the detection of climate change will be described.
Assessment:
Coursework 100%

SEMESTER: 1
COURSE CODE: BIOL 5202/BIOL 6202
COURSE TITLE: ENVIRONMENTAL LAW AND MULTILATERAL ENVIRONMENTAL AGREEMENTS
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course will provide students with a background to the sources for existing environmental laws, and of the specific framework for regulation of the environment in the Caribbean region. It will examine the ways in which human behaviour with respect to the environment is regulated at the international level, with specific reference to key biodiversity-related MEAs. This will involve a brief review of the legal and institutional framework within which international law making on the environment takes place. The course will provide students with a basic understanding of the existing legal environmental regimes of selected Caribbean countries.
The course will then articulate this regional framework within its international context. The course will introduce students to some of the factors that surround and influence the negotiation and implementation of international environmental law. Key MEAs, including the Convention on Biological Diversity, the Biosafety Protocol, the UN Convention on Climate Change, Cartagena Convention, RAMSAR, CITES and Principle on Forests will be used as examples to illustrate the key issues. Students will also be introduced to key regional environmental agreements, including the Cartagena Convention, SPAW Protocol. Additionally, students will be introduced to key issues specific to biodiversity conservation including bio-piracy, liability and redress, access and benefits sharing, and existing legal models for management of cross-border resources including migratory species and cross-jurisdictional protected natural areas.
Assessment:
Coursework 100%

SEMESTER: 2
COURSE CODE: BIOL 5203/BIOL 6203
COURSE TITLE: ENVIRONMENTAL ECONOMICS
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: The course will begin by introducing basic economic principles and exploring the limits of human nature in dealing with environmental degradation. It will then consider environmental economics from several perspectives, examine various economic tools and discuss their limitations. Using examples, it will then apply these tools to everyday scenarios that illustrate the possibilities and limitations of economics in resolving environmental and natural resource issues.
Assessment:
Coursework 100%

SEMESTER: 2
COURSE CODE: BIOL 5204/BIOL 6204
COURSE TITLE: ENVIRONMENTAL IMPACT ASSESSMENT
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: The course provides a general overview of the variety of environmental assessment tools currently available and an introduction to Environmental Impact Assessment (EIA) including definition, goals, objectives and purpose of EIA, definition of key terms, history of Environmental Impact Assessment and the legislative, policy and institutional framework for EIA. It will describe the EIA process, with emphasis on biodiversity conservation and sustainable use; the development of the Terms of Reference (TOR) including screening, scoping and public participation; and the assessment of project impacts, including understanding the ecosystem, assessment of significant impacts of the project and impact management. It will then consider reporting Environmental Impact Statement (EIS) and Environmental Management Plans, review of the EIS, linked to the TOR; and follow up monitoring, auditing, adaptive management and enforcement. Special consideration will be given to public participation, EIA standards, EIA for island, and Strategic Environmental Assessments.
Assessment:
Coursework 100%

SEMESTER: 1
COURSE CODE: BIOL 5205/BIOL 6205
COURSE TITLE: PRINCIPLES & PRACTICE OF GEOINFORMATICS
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course will provide an overview of the principles of geoinformatics including an introduction to geographic information systems, Global Positioning Systems and field survey techniques. Following an introduction to geoinformatics and definitions, the course will cover spatial data acquisition using GPS and field survey techniques, GIS data structures and capabilities. It will describe GIS and network analysis and spatial data analysis, and GIS functionality. Finally it will consider hardware and software systems and the design and implementation of GIS.
Assessment:
Coursework 100%

SEMESTER: 1
COURSE CODE: BIOL 5206/BIOL 6206
COURSE TITLE: MANAGEMENT & ANALYSIS OF ENVIRONMENTAL DATA
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course will provide practical training in data management and in statistical analysis of environmental data. Students will initially review fundamental univariate and bivariate statistical techniques, including basic parametric and non-parametric statistics. Students will then complete task sheets which, thereby, demonstrate an understanding of the application of appropriate tests to datasets. These sheets will be completed using R. The course will then progress to explore the use of multivariate statistical techniques to analyse detailed environmental datasets. Students will also be introduced to the use of Bayesian statistics, and biodiversity specific data analysis software including DISTANCE and Vortex.
Assessment:
Coursework 100%

SEMESTER: 1
COURSE CODE: BIOL 5207/BIOL 6207
COURSE TITLE: SUSTAINABLE USE & DEVELOPMENT OF NATURAL RESOURCES
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course will address important tropical ecosystem based industries including forestry, wildlife, agriculture, fisheries, energy, the pharmaceutical industry and tourism. In order to be sustainable, these industries will have to adopt environmental activities as core to their business, rather than consider them as an externality. Topics covered in this course will include an analysis and determination of land capability and optimal land use. Social aspects of land use and land degradation, and participatory approaches in sustainable development, will be discussed. The need for the integration of soil and water conservation in farming systems, and integration of water needs in agriculture with industrial and potable supply requirements. Agro-ecosystems will be considered in relation to sustainable mono-cropping, multiple cropping and agro-forestry systems for tropical environments. Sustainable forestry and timber production will also be examined. Participants to the course will also be exposed to development and exploitation of biodiversity for renewable energy (bio-fuels) and carbon sequestration in the context of REDD+ and related discussions in the Climate Change arena. Finally, current issues of fishery management will be examined as countries try to achieve sustainability in tropical capture fisheries, including management of freshwater environments for fisheries production, the integration of aquaculture production systems into agricultural and water conservation practices.
Assessment:
Coursework 100%

SEMESTER: 2
COURSE CODE: BIOL 5208/BIOL 6208
COURSE TITLE: CONSERVATION & MANAGEMENT OF BIODIVERSITY
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: The course will include development of priorities for species conservation, conservation of genes and genetic diversity, selection and design of protected areas, the application of island biogeography theory and SLOSS, population dynamics and population viability analysis to protected area design. Students will gain an understanding of the principles of protected area selection site management. The use of zoning schemes, particularly in relation to coastal zone management schemes will also be covered. The use of management plans will be discussed together with the assessment of management effectiveness. The course will also examine ex-situ conservation programmes and re-introductions of species as well as aspects of habitat restoration. The important role and participation of the public will also be considered with regard to the selection, design and management of protected areas as well as through the potential benefits of tourism and ecotourism.
Assessment:
Coursework 100%

SEMESTER: 1
COURSE CODE: BIOL 5209/BIOL 6209
COURSE TITLE: POLLUTION & ECOTOXIOCOLOGY
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course is designed to give students an understanding of the basic principles of pollution monitoring and ecotoxicology and how toxicants are distributed, taken up, assimilated and impact the environment. The course will also distinguish between structural and functional endpoints and how these can highlight the potential impacts of industry on the natural environment. The course will also look are particular pollutants that are of concern to Trinidad, such as: pesticides, industrial effluents and heavy metals. Students will also be able to understand how environmental monitoring tools such as toxicology, environmental chemistry and ecology can be used together to understand the relationship between industry and ecology by using these tools to conduct Ecological Risk Assessments.
Assessment:
Coursework 100%

SEMESTERS: 3 (SUMMER)
COURSE CODE: BIOL 5210/BIOL 6210
COURSE TITLE: FIELD PRACTICUM (BELIZE OR SURINAME)
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course comprises the main practical portion of the programme. It will provide students with the opportunity to apply and test their understanding of concepts covered in the taught courses of the programme, as well as allow them to develop their practical skills techniques, provide a face to face setting for interaction with faculty and with other distance learners on the programme. The course will go over the appropriate collection and survey techniques for various biological taxonomic groups. Status surveys and other population ecological work will be covered. Socio-economic survey work will also be undertaken in the field. (Students are expected to fund their own expenses incurred during and for this field course).
Assessment:
Coursework 100%

SEMESTER: 3 - 1
COURSE CODE: BIOL 6211
COURSE TITLE: RESEARCH PROJECT
NUMBER OF CREDITS: 12
PREREQUISITE: NONE
COURSE DESCRIPTION: The Research Project is a fundamental component of the M.Sc. programme and this is reflected, not only in the credit weighting, but by the fact that the M.Sc. runs for an extra 6 months so that the student may have the necessary time to complete the project to a high standard. Students will come to the Course Leader and/or University Focal Point during the first semester of the M.Sc. with potential ideas for their research project. A list of potential projects will be also be made available for those students who do not have a specific topic in mind. During the first two semesters, the student and Course Leader and/or University focal point will meet either face-to face or through a virtual platform (as determined by the Course Leader), at least twice, to further develop the research project idea, develop clear aims and objectives, and identify appropriate second supervisors. The research project may cover any feasible aspect of environmental management of tropical biodiversity. It may involve a pure research study toward a fundamental aspect of tropical biodiversity or address more applied issues in biodiversity conservation. It may involve field or laboratory based work or may be a desk study involving data analysis or interrogation of legal documents. It may support studies being undertaken by staff within UWI or the partner Universities of the MSc. Programme, or it may address an issue related to a student's employer. For students from outside of Trinidad, the project may be undertaken within Trinidad or in the student's home country. The project should, however, give the student a chance to further develop technical skills learnt during the field practicum and a more detailed understanding of some theoretical component of the course.
Assessment:
Coursework 100%

SEMESTER: 3 (SUMMER)
COURSE CODE: BIOL 5212/6212
COURSE TITLE: TAXONOMY AND BIODIVERSITY INFORMATICS
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This course is a core course in the programme, providing an understanding of the description and classification of organisms which is fundamental for biodiversity conservation. It provides an overview of the status of taxonomy and various classification systems, as well as a summary of the speciation process, biogeography and the field of molecular systematics. Species are identified as the building block for taxonomic classification and species concepts are discussed in detail. During the course, students will learn of the role of natural history museums and herbaria together with their collections in conservation. Collection and preservation methods for various taxa are presented and their curation is discussed. Identification methods and tools, including taxonomic keys, are presented and used as part of the course. The course includes a bioinformatics component that focuses on the use of online databases, as well as those found at local institutions. These include biodiversity databases, molecular databases and natural history collection databases. By the end of the course, students learn to use various databases to derive biodiversity information. The use of database management software is also emphasized as a tool for the creation of new biodiversity databases.
Assessment:
Coursework 100%

SEMESTER: 2
COURSE CODE: BIOL 5213/6213
COURSE TITLE: ADVANCED GIS
NUMBER OF CREDITS: 3
PREREQUISITE: BIOL 5205/6205
COURSE DESCRIPTION: This course commences with a brief review of GIS fundamentals including its historical development, data sources, data structures, hardware and software environments. It will provide students with an advanced view of database development and management and image processing. Students will then review land cover preparation and develop an understanding of the range of available spatial statistical tools and sources for various types of spatial data. The students will then be introduced to Windows-based visual basic environments and spend some time developing their skills in developing GIS modules for these environments, as well as introduce them to the range of GIS platforms available for biodiversity problem-solving. The final third of the course will focus, through case studies, on the use of GIS to problem-solve in the fields of fisheries, threatened species management and climate change modelling. Students will then be presented with biodiversity problems which can be addressed through GIS, and asked to develop individual solutions for these GIS based problem sets.
Assessment:
Coursework 100%

SEMESTER: 2
COURSE CODE: BIOL 5214/6214
COURSE TITLE: ENVIRONMENTAL RESOURCES POLICY
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: This policy course provides an overview of the basic foundations for environmental resource policy, its evolution and the linkages with a wide scope of socio-economic and socio-ecological issues. It affords students the opportunity to understand the various concepts of environmentally and ecologically sustainable development processes emerging from social consciousness of environmental impacts on natural resources and their management. It provides a learning process for understanding the basic principles involved in setting environmental resource goals and articulating a vision for various environmental resource policies. Key natural resource issues are reviewed from the perspective of developing policy making processes using best practices. It provides students with a level of understanding of the relevant issues and techniques for scoping and developing environmental resource policies. Students are afforded the opportunity to prepare policy briefs for specific environmental and natural resource issues including a step-by-step policy making exercises and simulations of practical problems and issues involved in the policy making process. Overviews of carefully selected international environmental instruments and their nexus with natural resource management and environmental drivers facilitate an understanding of the globalization of environmental policy making. It provides opportunities for students to have basic understanding and appreciation for environmental resource governance models and how these impact policy.
Assessment:
Coursework 100%

SEMESTER: 2
COURSE CODE: BIOL 5215/6215
COURSE TITLE: SOCIO-ECOLOGY AND NATURAL RESOURCES MANAGEMENT
NUMBER OF CREDITS: 3
PREREQUISITE: NONE
COURSE DESCRIPTION: Successful natural resources management requires the development of consensus of all stakeholders on the goals of such management and the activities to be undertaken to achieve such goals. The need for such a consensual approach is especially important in biodiversity management situations where indigenous, tribal and rural communities have traditionally used or hold rights to access and utilization of such resources. To enable the students to understand the context for these types of challenging resource management scenarios, the course begins by introducing current sociological thinking on the nature of, and relationships between, human values, beliefs, and attitudes to nature. It then reviews western scientific approaches to renewable resources management in the context of traditional economically driven resource production. The students will then review through case studies regional examples of natural resources use by rural, tribal indigenous peoples and compare and contrast the basis for these interactions with western, science-based natural resources management. Finally, the students will be introduced to the basic tools currently used by natural resource managers to assess impacts on management interventions on rural and indigenous peoples, and tools for integrating these communities in resource management decision making.
Assessment:
Coursework 100%

ADDITIONAL COURSES TO BE OFFERED IN 2013/2014

The following four (4) credit courses offered by the Department of Life Sciences are available for MPhil/ PhD students:

Course Code	Course Title
BIOL 6062	Bioethics
BIOL 7063	Light Microscopy & Digital Image Processing

COURSE DESCRIPTIONS

SEMESTER: 2
COURSE CODE: BIOL 6062
COURSE TITLE: BIOETHICS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: The course is designed to expose postgraduate students to a wide assay of topics from various disciplines. The field of bioethics is not dominated by a single discipline but rather it concerns cross disciplines, that is, they are both scientific and ethical. Hence this course provides the opportunity for sustained, cross-disciplinary work in the fields of biology, natural sciences, medicine, philosophy, sociology, demography and theology. It enables a student to pursue topics where life sciences and ethics converge. Some of the areas that postgraduates should have some working knowledge of and which shall be helpful while pursuing the course in bioethics include genetics, use of scientific technology, allocation of resources, philosophy of science, environmental studies and so on.
Assessment:

Coursework	60%
Final Examination	40%

SEMESTER: 3 (SUMMER) I
COURSE CODE: BIOL 7063
COURSE TITLE: LIGHT MICROSCOPY & DIGITAL IMAGE PROCESSING
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: The course provides theoretical and practical background information, as well as hands-on experience, with a variety of advanced light microscopy and image processing techniques. Since individual supervision is provided during the integrated lecture and practical sessions, enrolment is limited to about six students whose research will benefit significantly from what the course has to offer. Students must consult with the lecturer prior to registering for BIOL7063
Assessment:

Coursework	40%
Final Examination	60%

DEPARTMENT OF MATHEMATICS AND STATISTICS

MAIN OFFICE
2nd Floor, Natural Sciences Building
Tel: (868) 662-2002 Exts. 82049, 83553, 83641
Fax: (868) 645-7132
Email: dms@sta.uwi.edu

STAFF LISTING

HEAD OF DEPARTMENT
Dr. Robin Antoine
Ext. 82048
Email: robin.antoine@sta.uwi.edu

ADMINISTRATIVE ASSISTANT
Mrs. Deloris Adams-Carrington
BSc (UWI)
Ext 83780
Email: deloris.adams@sta.uwi.edu

SECRETARY
Ms. Nisha Hazelwood
Exts. 82048, 82049
Email: nisha.hazelwood@sta.uwi.edu

RECEPTION - CLERICAL ASSISTANTS
Ms. Cristal Warner
Ext. 83553
Email: cristal.warner@sta.uwi.edu

Mr. Wendell Alexander
Ext. 83641
Email: wendell.alexander@sta.uwi.edu

ACADEMIC STAFF
R. Antoine
BSc, MSc (UWI), MS, PhD (FSU)
Senior Lecturer, Mathematics
Ext. 82048
Email: robin.antoine@sta.uwi.edu

B. Bhatt
BSc, MSc, PhD (University of Rajasthan), FIMA
Professor, Mathematics
Ext. 83859
Email: bal.bhatt@sta.uwi.edu

D. Comissiong
BSc, MPhil, (UWI), PhD (Northwestern Univ.)
Lecturer, Mathematics
Ext. 83099
Email: donna.comissiong@sta.uwi.edu

C. de Matas
BSc, MPhil (UWI), MA (Pgh), PhD (UWI)
Lecturer, Mathematics
Ext. 83499
Email: charles.dematas@sta.uwi.edu

I. Dialsingh
BSc, M.Sc (UWI), PhD (PSU)
Lecturer, Mathematics
Ext. 83554
Email: isaac.dialsingh@sta.uwi.edu

D. Doctor
BSc, MSc (UWI), ASA
Lecturer, Actuarial Science
Ext. 83947
Email: dane.doctor@sta.uwi.edu

E.J. Farrell
BSc (UWI), M.Math. PhD (Wat), FTICA
Professor Emeritus
Ext. 83102
E-mail: edward.farrell@sta.uwi.edu

S.R. Gunakala
BSc (Acharya Nagarjuna Univ.- India),
MSc (Osmania Univ. - India),
MPhil (Madurai Kamaraj Univ. - India),
PhD (Sri Venkateswara Univ. - India)
Lecturer, Mathematics
Ext. 84491
Email: sreedhara.rao@sta.uwi.edu

C. Hamburger
Dipl. in Physics, Dr.rer.nat. (Maths.), Dr. habil. (Maths.), (Germany)
Lecturer, Mathematics
Ext. 83950
Email: christoph.hamburger@sta.uwi.edu

K. Rahaman
BSc, PhD (UWI)
Senior Lecturer, Mathematics
Ext. 83082
Email: karim.rahaman@sta.uwi.edu

H. Ramkissoon
BSc (UWI), MSc (Tor), PhD (Calg)
Professor Emeritus
Ext. 82529
Email: harold.ramkissoon@sta.uwi.edu

A. Shirley
BSc (UWI), MSc, PhD (Northeastern)
Lecturer, Mathematics
Ext. 82495
Email: angela.shirley@sta.uwi.edu

S. Smart
H.B.Sc. LL.B, FSA, CERA, PRM
Lecturer, Actuarial Science
Ext. 83553
Email: stokeley.smart@sta.uwi.edu

V. Tripathi
BSc, MSc PhD (Agra)
Senior Lecturer, Statistics
Ext. 83872
Email: vrijesh.tripathi@sta.uwi.edu

S. Wahid
BSc, MPhil, PhD, (UWI), FTICA
Senior Lecturer, Mathematics
Ext. 83081
Email: shanaz.wahid@sta.uwi.edu

RESEARCH INTERESTS AND FACILITIES

The Department of Mathematics and Statistics offers MSc Degrees in Mathematics and in Statistics. The Department also offers programmes leading to the MPhil and PhD degrees. The MSc degrees are awarded on the basis of taught courses and a research project.

The MPhil and PhD are research degrees awarded on the submission and successful defence of a thesis. Each MPhil/ PhD student must also do a minimum of 8/9 credits at graduate level, as recommended by his/her Supervisor. After evaluation by his/her supervisor, MPhil and PhD candidates may be required by the Department to take substantially more credits of taught courses than the University stipulated minimum.Interested applicants should consult the Head of the Department concerning available research facilities.

Transfer from the MPhil to the PhD degree programme is possible but depends on the progress of the research undertaken and the recommendation of the supervisor and the approval of the Board for Graduate Studies and Research.

In Mathematics, the current research areas are Graph Theory and Combinatorics, Fluid Dynamics, Mathematical Modelling and Biomathematics.

PROGRAMMES

MSc in Statistics

Objectives

To provide graduates with a comprehensive and advanced knowledge of Statistics so as to enable them to function effectively as professional Statisticians and to provide them with an adequate background for further study and research in Statistics.

PROGRAMME CO-ORDINATOR: DR. ROBIN ANTOINE

Entry Requirements

To be admitted to the programme a candidate should possess a BSc degree with at least Lower Second Class Honours or its equivalent (GPA 2.0). Candidates are expected to have a minimum grade B (quality point 3.0) in the following courses or its equivalent:

Course Code	Title
MATH 2110	Linear Algebra
MATH 2120	Analysis & Mathematical Methods I
MATH 2140	Introduction to Probability
MATH 2150	Introduction to Statistics

In addition to the above, the following courses offered by the Department of Mathematics and Statistics will be an asset: MATH 3450 (M 35A) Statistical Theory I and MATH 3460 (M 35B) Statistical Theory II. Applicants who do not satisfy these requirements may be admitted upon successful completion of qualifying courses.

Course of Study

For the MSc programme in Statistics, students are required to complete (32 credits) consisting of:

(i) 5 core courses (20 credits)

AND

(ii) 3 elective courses (12 credits) with an 8-credit Research Project (STAT 6000) which must be chosen in collaboration with at least one Lecturer in Statistics.

The course of study shall extend over one (1) year of full time study or two (2) years of part time study, however, at the present time, only a part-time programme is available.

Examination

Students will be required to pass both the coursework and the written examination. The pass mark is 50%. The grading scheme for graduate degrees is as follows: A 70 - 100%; B+ 60-69%; B 50-59%. In the case of the Research Project, evaluation will be based on the project report.

Award of Degree

To qualify for the award of the degree, candidates must pass all five Core courses, three Elective courses and the Research Project. The degree shall be awarded in two categories - Distinction and Pass. For the award of the degree with distinction, the candidate must have obtained an average mark of 70% or more, across all Core courses and Elective courses as well as 70% or more in the Research Project.

A candidate failing a course shall be ineligible for the award of distinction.

CORE COURSES: (4 CREDITS EACH)

Course Code	Title
STAT 6100	Applied Probability Theory
STAT 6110	Applied Statistical Inference
STAT 6120	Linear Statistical Methods
STAT 6130	Sampling Theory & Techniques
STAT 6140	Experimental Design and Analysis

SELECT 3 OF THE FOLLOWING ELECTIVE COURSES (4 CREDITS)

Course Code	Title
STAT 6150	Stochastic Process & Applications
STAT 6160	Data Analysis
STAT 6170	Multivariate Analysis
STAT 6180	Advanced Topics in Statistics

COURSE DESCRIPTIONS

SEMESTER: 1
COURSE CODE: STAT 6100
COURSE TITLE: APPLIED PROBABILITY THEORY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Foundations of Probability; Distributions of One and Several Discrete and Continuous Random Variables; Expectations, Moments, Moment Generating Functions and Characteristic Functions; Order Statistics; The Bivariate and Multivariate Normal Distributions; Sampling Distributions; Distributions of Quadratic Forms; Poisson Process; Markov Chains and Markov Processes; Convergence in Distribution and Convergence in Probability.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: 2
COURSE CODE: STAT 6110
COURSE TITLE: APPLIED STATISTICAL INFERENCE
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Point and Interval Estimation; Maximum Likelihood Estimation; Hypothesis Testing; The Neyman-Pearson Theory; Likelihood Ratio Tests; The Elements of Bayesian Inference.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: 1
COURSE CODE: STAT 6120
COURSE TITLE: LINEAR STATISTICAL METHODS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Generalized Inverses of Matrices; Distribution of Linear and Quadratic Forms; Regression of Full Rank Models; Models of Less than Full Rank; Estimation and Tests of Hypotheses for Full Rank and Non-full Rank Models; Reduction of Sum of Squares; ANOVA for Balanced and Unbalanced Designs Components of Variance Models.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: STAT 6130
COURSE TITLE: SAMPLING THEORY AND TECHNIQUES
NUMBER OF CREDITS: 4
COURSE DESCRIPTION: Theory of Equal and Unequal Probability Sampling; Selected Topics from Simple Random Sampling, Stratified Sampling, Systematic Sampling and PPS Sampling; Ratio and Regression Estimation; Two-stage and k-stage Sub-sampling Procedures; Double Sampling Procedure; Repetitive Surveys; Non-sampling Errors.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: 2
COURSE CODE: STAT 6140
COURSE TITLE: EXPERIMENTAL DESIGN AND ANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Designs for Eliminating One-way, Two-way, Three-way and Multi-way Heterogeneity; Fixed, Mixed and Random Effects Models; Incomplete Block Designs; Factorial and Fractional Factorial Designs; Responses Surface Methods; Confounded Designs; Analysis of Covariance.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: STAT 6150
COURSE TITLE: STOCHASTIC PROCESSES AND APPLICATIONS
NUMBER OF CREDITS: 4
PREREQUISITE(S): STAT 6100
COURSE DESCRIPTION: Markov Chains; Markov processes with discrete states in continuous time; Queueing Theory; Renewal Theory; Branching Processes, Epidemic Theory.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: 2
COURSE CODE: STAT 6160
COURSE TITLE: DATA ANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Topics selected from Trimmed Means and Winsorised Means; Transformations; Assessment of Normality; Detection of Outliers; Robust Methods; Monte Carlo Methods; Jackknife and Bootstrap Techniques; Regression Diagnostics; Censored Data Analysis; Graphical Methods of Data Analysis; Use of Statistical Software; Generalised Linear Models and Categorical Data Analysis.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: 1
COURSE CODE: STAT 6170
COURSE TITLE: MULTIVARIATE ANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Multivariate Distributions; Normal, Wishart, T and Others with Applications; Regression Correlation and General Linear Hypothesis in the Multivariate setting; MANOVA and MANOCOVA; Principal Component Analysis; Factor Analysis; Cluster Analysis; Multidimensional Scaling.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: STAT 6180
COURSE TITLE: ADVANCED TOPICS IN STATISTICS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: The Bootstrap; The E-M algorithm Markov Chain Monte Carlo Methods; Empirical Bayes Methods.
Assessment:

Coursework	40%
Final Examination: One 3 hour written paper	60%

MSc in Mathematics

OBJECTIVES
To impart a knowledge of Mathematics which would enable graduates to perform more effectively in the workplace and also enhance their research capability.

PROGRAMME CO-ORDINATOR: DR. DONNA COMISSIONG
Entry Requirements
To be admitted to the programme, a candidate should (normally) possess a BSc degree majoring in Mathematics or equivalent (minimum GPA 2.0) with at least Lower Second Class Honours. Candidates with lower qualifications may be considered but will be required to pass qualifying courses, as prescribed by the department. All candidates must have passed the following courses (or its equivalent):

Course Code	Title
MATH 2100	Abstract Algebra
MATH 2110	Linear Algebra
MATH 2120	Analysis & Mathematical Methods I
MATH 2160	Analysis & Mathematical Methods II

Duration of study
The course of study will extend over one year of full-time study or two years of part-time study. Part-time students will normally be required to complete the degree within two years of registration; and must complete it within three years.

Examination
Students will be required to pass both the coursework and the written examination. The pass mark is 50%. The grading scheme for graduate degrees is as follows: A 70 - 100%; B+ 60-69%; B 50-59%. In the case of the Research Project, evaluation will be based on the project report.

Award of Degree
To qualify for the award of the degree, candidates must pass all three Core courses, five/six Elective courses and the Research Project. The degree shall be awarded in two categories - Distinction and Pass. For the award of the degree with distinction, the candidate must have obtained an average mark of 70% or more, across all Core courses and Elective courses as well as 70% or more in the Research Project.

A candidate failing a course shall be ineligible for the award of distinction.

Course of Study
The MSc programme consists of 3 core courses **and** 5/6 electives
Either
(i) 5 elective courses and an 8-credit Research Project. (**MATH 6000)**
OR
(ii) 6 elective courses and a 4-credit Research Project. (**MATH 6001**)

A Research Project must be chosen in collaboration with at least one Lecturer in Mathematics. An 8- credit project is equivalent to two courses. A 4- credit project is equivalent to one course.

CORE COURSES: (4 CREDITS EACH)

Course Code	Title
MATH 6100	Algebra (Group Theory and Applications)
MATH 6110	Real Analysis
MATH 6120	Differential Equations

ELECTIVE COURSES: (4 CREDITS EACH)

Course Code	Title
MATH 6130	Algebra (Group Actions)
MATH 6140	Advanced Mathematical Methods
MATH 6150	Viscous Flows
MATH 6160	An Introduction to Non-Newtonian Fluid Mechanics
MATH 6170	Advanced Discrete Mathematics (F-Polynomials of Graphs)
MATH 6180	Probability
MATH 6190	Numerical Analysis
MATH 6191	Asymptotic & Perturbation Analysis
MATH 6192	Advanced Mathematical Modeling
MATH 6193	Numerical Methods for Partial Differential Equations
MATH 6310	Complex Analysis
MATH 6620	Topology
MATH 6630	Functions Analysis
MATH 6640	Theory of Integration

COURSE DESCRIPTIONS

SEMESTER: 2
COURSE CODE: MATH 6100
COURSE TITLE: ALGEBRA (GROUP THEORY AND APPLICATIONS)
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Group Theory; Commutators, Centralisers and Nomalisers; The Homomorphism Theorems; The Sylow Theorems; The Class Equation of a Group; Theory of p-groups; Solvable Groups; The Jordan-Holder Theorem; Simple Groups; Direct Product of Groups. Applications Groups and Symmetry; Group Actions on Sets; Stabilisers Symmetry Groups in Two Dimensions; Matrix Groups; Rotations of Regular Solids; Finite Rotation Groups in Three Dimensions; Polya-Burnside Theorem and applications;.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: 1
COURSE CODE: MATH 6110
COURSE TITLE: REAL ANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Topological spaces [Neighbourhood system, topological subspaces]; Interior closure, Frontier [Including dense and perfect sets]; Compactness; Connectedness; Metric Spaces; Continuity and Homeomorphism; Lesbegue Integral
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: 1
COURSE CODE: MATH 6120
COURSE TITLE: DIFFERENTIAL EQUATIONS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Existence and uniqueness of solutions. Linear Systems. Stability of linear and weakly non-linear systems. Second-order Differential equations. The boundary value problem.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6130
COURSE TITLE: ALGEBRA (GROUP ACTIONS)
NUMBER OF CREDITS: 4
PREREQUISITE: MATH3430 or MATH6100
COURSE DESCRIPTION: Introduction to Finite Group Theory; Groups and Homomorphism; Group Actions on Sets; Groups of Even orders; Finite p-groups; Normal Series; Direct Products and the Structures of Finitely Generated Abelian Groups; Group Actions on Groups.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6140
COURSE TITLE: ADVANCED MATHEMATICAL METHODS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: General Theory of Eigenvalues and Eigenfunctions, The Minimum Problem, Sequences of Eigenvalues and Eigenfunctions, Variational Properties, Eigenfunction Expansions, The Rayleigh-Ritz Approximation Method.

Green's Functions Inverses of Differential Operators, Examples of Green's Functions, The Neumann and Robin Functions, Source Functions for Parabolic Equations.

Cylindrical Eigenfunctions
Bessel Functions, Eigenfunctions for Finite Regions, The Fourier-Bessel Series, The Green's Function, Modified Bessell Functions.

Spherical Eigenfunctions
Legendre Functions, Eigenfunctions of the Spherical Surface, Eigenfunctions for the Solid Sphere.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: 2
COURSE CODE: MATH 6150
COURSE TITLE: VISCOUS FLOWS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Equations of Viscous Flow Kinematics and Dynamics of Flow, Energy Considerations, Boundary Conditions, Dimensional Analysis, Reynolds Number.

Exact Solutions
Some Exact Solutions including Flow Generated by an Oscillating Plate, Helical Flow in an Annular Region, Hamell's Problem of Flow in a Wedged-Shape Region, Flow Generated by a Rotating Disc.

Axially Symmetric Rotary Flows
Flow between Parallel Discs, Flow between Coaxial Cones, Flow between Concentric Spheres - A Secondary Flow.

Flow Past a Sphere
Creeping Flow Past a Sphere, Ossen's Criticism, Matching Techniques.

Lubrication Theory
Physical Origin of Fluid-Film Lubrication, The Mathematical foundations of Lubrication Theory, Slider Bearing, Squeeze Films, Journal Bearings.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6160
COURSE TITLE: AN INTRODUCTION TO NON-NEWTONIAN FLUID MECHANICS
NUMBER OF CREDITS: 4
PREREQUISITE: MATH 6150
COURSE DESCRIPTION: Principles of Continuum Mechanics Basic Concepts, Material Derivative, Deformation Rates, Rivlin - Ericksen Tensors, Strain Tensors, Kinematics of Steady Shear Flows, Continuity Equation, Stress and Volume Force, Equations of Motion, Energy Equation.

Material Properties Occurring in Steady Shear Flows; Flow Function, Normal Stress Functions.

Processes that are controlled by the Flow Function; Rotational Viscometer, Pressure- Drag Flow in a Straight Channel, Radial Flow Between Two Parallel Planes, Pipe Flow, Helical Flow.

Effect of Normal Stress Differences
Cone-and Plate-Flow, Weissenberg Effect, Die-Swell, Axial Shear Flow.

Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6170
COURSE TITLE: ADVANCED DISCRETE MATHEMATICS (F-POLYNOMIALS OF GRAPHS)
NUMBER OF CREDITS: 4
PREREQUISITE: MATH 3290 and MATH 3400
COURSE DESCRIPTION: Review of Generating Functions and Solutions of Recurrence Relations using Generating Functions. General F-polynomials of Graphs, Matching Polynomials, Circuit Polynomials, Tree Polynomials and Sub-graph Polynomials. Relationships with other Graph Polynomials.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6180
COURSE TITLE: PROBABILITY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Review of Distribution Theory; Poisson Process; Finite Markov Chains; Continuous time Markov Chains; Renewal Theory; Branching Process; Epidemic Theory.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: 1
COURSE CODE: MATH 6190
COURSE TITLE: NUMERICAL ANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Review of Computer errors. Programming in MATLAB. Solution of non-linear equations.

Numerical Linear Algebra
LU and Cholesky factorizations. Pivoting. Norms and analysis of errors. Iterative methods. The matrix eigenvalue problem. The singular-value decomposition and pseudo-inverses.

Approximation of Functions
Polynomial interpolation. Hermite interpolation. Spline interpolation. Best approximation: Least squares and Chebyshev.
Trigonometric interpolation and the Fast Fourier Transform.
Numerical differentiation and integration
Gaussian and adaptive quadrature.

Numerical solution of ordinary differential equations
Existence and uniqueness of solutions. Runge-Kutta and multi-step methods. Local and global errors. Stability.
Boundary-value problems: Shooting methods. Finite-difference methods. Collocation.
Stiff equations.

Introduction to the numerical solution of partial differential equation
Elliptic, parabolic and hyperbolic partial differential equations.
Assessment:

Coursework	25%
Final Examination: One 3 hour written paper	75%

SEMESTER: 2
COURSE CODE: MATH 6191
COURSE TITLE: ASYMPTOTIC & PERTURBATIONANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Introduction to asymptotic approximations; Regular and singular perturbation methods for ordinary and partial differential equations; Matched asymptotic expansions: Boundary layer theory, outer and inner solutions with matching principles, interior layers, corner layers; Introduction to Multiple Scales: Slowly varying coefficients, forced motion near resonance, Floquet theory, Wittaker's method; Boundary layers by multiple scales; Nonlinear oscillators; Bifurcation Theory: Hopf bifurcations, weakly non-linear analysis; Two-time and uniform expansions.
Assessment:

Coursework	30%
Final Examination	70%
(Consisting of: One take home exam 35% and one 3 hour written paper 35%)	

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6192
COURSE TITLE: ADVANCED MATHEMATICAL MODELLING
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: Models from Newton's laws of motion: Planetary motion, energy conservation laws, resonance phenomena, surface area and minimal energy configurations; Lagrangian/Eulerian equations of motion: trajectories of particles, caustics; Linear stability analysis for oscillating systems, modelling of two-layer fluid systems, Rayleigh-Taylor instability; Heat flow problems: characteristic time of cooling, chemically reactive systems, convection-diffusion systems; Particle motion: Probability density functions, predicting particle positions, nearest neighbour interactions; Theory of Elasticity: Stress-strain relations, elastic and plastic deformation; Laws of interaction: Forces between charged particles, principle of superposition, electromagnetic forces, Faraday's law of magnetic induction; Interfaces and fronts: Modelling explosive systems with thin reaction zone kinetics - SHS, Frontal Polymerisation.
Assessment:
Research Project (written report and oral presentation 40%
Final Examination: One 3 hour written paper 60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6193
COURSE TITLE: NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
Computer literacy is expected. Prior knowledge of mathematical software packages such as MATLAB would be an asset.
COURSE DESCRIPTION: Preliminaries: classification of partial differential equations; Well-posedness; Spatial differences: central differences; Fourier analysis; Higher order difference approximations; One-sided differencing; Temporal errors: Concepts of stability and accuracy; analysis of dispersive and dissipative error; Mostly explicit difference schemes: Forward Euler in time, Central difference in space; Lax-Friedrichs; Leap-frog (2-2) and (2-4); Concept of artificial dissipation; Lax-Wendroff; MacCormack's scheme; Runge-Kutta time stepping; Systems of equations: Decoupling; disparate speeds; Implicit schemes: Backward Euler; Crank-Nicholson; compact 4th order approximation for spatial derivatives; implicit schemes for systems; Semi-implicit schemes: Adams-Bashforth multi-step method; Parabolic equations and methods for their numerical solution; Numerical approximation of boundary conditions (for parabolic and hyperbolic equations): Extrapolating boundary conditions; one sided differences; linear systems; Two-dimensional problems: Operator splitting; Alternating directions implicit method; Anisotropic errors, 2-D boundary conditions.
Assessment:
Coursework 40%
(4 Computer Lab Group Assignments)
Final Examination: One 3 hour written paper 60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6310
COURSE TITLE: COMPLEX ANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COUSE DESCRIPTION: The course develops the properties of the complex number system, treated as a generalization of the real number system. We explore the parallel analysis that results, with a particular emphasis on differentiability, analyticity, contour integrals, Cauchy's theorem, Laurent series representation, and residue calculus.
Core topics include: complex numbers, analytic functions and their properties, derivatives, integrals, series representations, residues, and conformal mappings. Application of the calculus of residues and mapping techniques to the solution of common boundary value problems encountered in physics and engineering applications is a major part of the course. Students are expected to have a strong background in advanced undergraduate calculus of real variables. An earlier or concurrent course in differential equations is an asset, but is not a prerequisite for this course.
Assessment:
Coursework : 40%
(Two 15% Coursework examinations and
10% Assignments based on four assignments
given during the semester)
Final Examination: One 3-hour written paper 60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6620
COURSE TITLE: TOPOLOGY
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: This course serves as a broad introduction to the basic notions of General Topology, Metric spaces, Continuity and Homeomorphism, Compactness, connectedness and separation axioms. Students taking this course must therefore have a thorough understanding of undergraduate level real analysis.
Assessment
Coursework: 40%
(Two 15% Coursework examinations and
10% Assignments, based on four assignments
given during the semester)
Final Examination: One 3-hour written paper 60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6630
COURSE TITLE: FUNCTIONAL ANALYSIS
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: This course aims at familiarizing the student with the basic concepts, principles and methods of functional analysis and its applications. The principles learnt from basic calculus and linear algebra will be developed further to the more general setting of abstract infinite-dimensional vector spaces. Students will therefore be expected to have a solid background in undergraduate calculus, real analysis, and liner algebra.
Students will be introduced to the notion of vector spaces and the distance between vectors, as well as to continuous maps between such vector spaces. This interplay between the algebraic and analytic setting gives rise to many interesting and useful results, which have a wide range of applicability to diverse mathematical problems, such as from numerical analysis, differential and integral equations, optimization and approximation theory.
The first part of the course is devoted to a short introduction in the theory of metric spaces and to a detailed study of normed and Banach spaces and in particular to the analysis of linear operators acting upon them. The second part of the course deals with Hilbert spaces and linear operators upon them, since they play a fundamental role in applied mathematics. Finally, we look at some fundamental theorems for normed and Banach spaces such as the Hahn-Banach theorem for complex vector spaces and normed spaces and its application to bounded linear functionals; the uniform boundedness theorem, and the closed Graph theorem.
Assessment

Coursework:	40%
Two 15% Coursework examinations and 10% Assignments based on four assignments given during the semester	
Final Examination: One 3-hour written paper	60%

SEMESTER: NOT OFFERED IN 2013/2014
COURSE CODE: MATH 6640
COURSE TITLE: THEORY OF INTEGRATION
NUMBER OF CREDITS: 4
PREREQUISITE: NONE
COURSE DESCRIPTION: In this course, we consider the limitations of the Riemann integral, and show that it is necessary to develop a precise mathematical notion of 'length' and 'area' in order to overcome these deficiencies. In so doing, we create a precise concept of measure, and use it to construct the more powerful Lebesgue integral. Finally we look at applications of measure and Lebesgue integration in modern probability theory.
Students will be expected to have a solid background in undergraduate calculus and real analysis.
Assessment

Coursework:	40%
Two 15% Coursework examinations and 10% Assignments based on four assignments given during the semester)	
Final Examination: One 3-hour written paper	60%

DEPARTMENT OF PHYSICS

3rd Floor, Natural Sciences Building
Tel: (868) 662-2002 Exts. 82050, 82051
Fax: (868) 662-9904
Email: physics@sta.uwi.edu

STAFF LISTING

HEAD OF DEPARTMENT
Dr. Ricardo Clarke
Ext. 82050
E-mail: physics@sta.uwi.edu

ADMINISTRATIVE ASSISTANT
Mrs. Zuwena Williams-Paul
BSc, MSc (UWI)
Ext. 83846
Email: zuwena.williams-paul@sta.uwi.edu

SECRETARY
Mrs. Virginia Briggs
Tel: (868) 662-2002
Exts. 82050, 82051
Fax: (868) 662-9904
Email: virginia.sadd-nagim@sta.uwi.edu

CLERICAL ASSISTANT
Mrs. Jane Sookdhan-Browne
Ext. 83113
Email: jane.sookdhan@sta.uwi.edu

ACADEMIC STAFF
R. Andrews
BSc, PhD (Lond.)
Lecturer, Quantum Physics and Solar Energy Technologies
Ext. 83114
Email: roger.andrews@sta.uwi.edu

R. Clarke
BSc, M. Phil. (UWI), PhD (UWI)
Lecturer, Environmental Physics
Ext. 83121
Email: ricardo.clarke@sta.uwi.edu

K. De Souza
BSc, MSc, (UWI) PhD (Southampton)
Lecturer, Optoelectronics and Solar Energy Technologies
Ext. 83103
Email: keith.desouza@sta.uwi.edu

S. Haque
BSc (UWI), MPhil (UWI), PhD (UWI)
Senior Lecturer, Astronomy
Ext. 83123
Email: shirin.haque@sta.uwi.edu

I. Haraksingh
BSc, (UWI), PhD(UWI)
Lecturer, Environmental Physics
Ext. 83122
Email: indra.haraksingh@sta.uwi.edu

J.C. Knight
BSc (UWI), PhD (Camb.)
Senior Lecturer, Materials Science
Ext. 83125
Email: joscelyn.knight@sta.uwi.edu

H. P. S. Missan
BSc, MSc, PhD (GNDU)
Lecturer, Materials Science
Ext. 83116
Email: harinder.missan@sta.uwi.edu

S. Sekhon
BSc (GNDU), MSc, PhD (Punjabi)
Professor, Physics
Ext. 83113

D. P. Sharma
BSc, MSc, PhD (GNDU)
Lecturer, Signal Processing and VLSI
Ext. 83105
Email: davinder.sharma@sta.uwi.edu

S. Williams
BSc, (UWI), MPhil (UWI), MSc (Lough.) PhD (RWTH Aachen)
Lecturer, Medical Physics
Ext. 83124
Email: sybele.williams@sta.uwi.edu

N. Zyuzikov
BSc, (MEPHI), MSc (QMUL), PhD (MRRC)
Lecturer, Radiation and Medical Physics
Ext. 83113
Email: nikolay.zyuzikov@sta.uwi.edu

ABOUT THE DEPARTMENT OF PHYSICS

The Department of Physics at St. Augustine offers opportunities for postgraduate studies leading to MPhil and PhD degrees by research and thesis.

Normally all students register for an MPhil degree but after a year it is possible to upgrade one's registration to a PhD degree on the recommendation of the supervisor and the approval of the Board for Higher degrees.

The minimum qualification for admission to the MPhil programme is a BSc General Honours degree in Physics (minimum GPA 3.0) or its equivalent from an approved University.

A candidate admitted for postgraduate studies with a **Pass** or a **Lower Second Bachelor's** degree or equivalent is normally required to take a qualifying examination by the end of the first year. Passing of the qualifying examination is a pre-requisite for the continuation of postgraduate studies and submission of thesis.

RESEARCH INTERESTS AND FACILITIES

The current research in progress or research areas where activities are planned include:

(1) FUEL CELL AND LITHIUM BATTERY RESEARCH

The Fuel Cell and Lithium Battery Research is carried out at Caribbean's First Fuel Cell Materials Research Lab (FCMRL) at Dept. of Physics and broad areas are as follows:

a. Development of Membranes for Fuel Cells:
The main area of research is to develop new and novel electrolyte membranes for applications in Polymer Electrolyte Membrane Fuel Cells (PEMFC) and Direct Methanol Fuel Cells (DMFC's). Various chemical and physical techniques are used to develop these membranes. The membranes developed are then evaluated using various characterization techniques and later tested in fuel cells. Research on materials for Solid Oxide Fuel Cells (SOFC's) will be started shortly.

b. Development of Catalysts for Fuel Cells:
New and novel catalysts are under process of development at FCMRL. The goal is to develop new non platinum based catalysts to work with the developed membranes. Research is also carried out on the nano tubular support for the catalysts and their testing in fuel cells.

c. Modelling of Fuel Cells:
Modelling is a very important aspect of fuel cell development and is done to evaluate various parameters related to fuel cell in order to use top to bottom approach in fuel cell development. Various models for different phenomenon are developed using various software's like Matlab etc.

d. Development of Dye sensitized Solar Cells:
Materials for application in Dye sensitized solar cells are also synthesized and dyes are made in collaboration with Chemistry Department. Solar cells will be synthesized and tested in future.

e. Development of Electrolytes for Lithium Batteries:
Non-aqueous polymer electrolytes in gel as well as film form are developed under this area of research for application in lithium batteries. Various techniques are used including acid-base approach, ternary system approach, polymer-in-salt approach etc. The materials developed are tested for their suitability in lithium batteries using different characterization techniques.

(2) CERAMICS AND REFRACTORIES

a. Development of ceramics and refractories based on regional materials for a wide range of applications. Current research includes:
- Chemical and mineralogical characterisation of raw materials, compositional studies, synthesis, high-temperature solid-state reactions,
- Physical and mechanical testing, x-ray and electron microscopy. Analyses, micro-structure/ property relationships.

(3) MEDICAL PHYSICS AND BIOENGINEERING

- Recordings of mass potentials as well as signals from neurons to determine the manner in which the brain interacts with its neural network functions. EEG studies.
- Blood flow studies for photoplethysmography
- Magnetocardiography using superconducting quantum interference device (SQUID).
- Objective assessment of the scoliotic spine.
- Anthropometrics and ergonomics.
- Assessment of human movement, fitness testing
- Radiation biology and Medicine
- Low doses and Non-Targeted effects of ionizing radiation

(4) ASTRONOMY

a. Theoretical Astronomy
- The area of focus in theoretical astronomy is with statistical analyses on the large scale structure of the Universe as well as quasars.

b. Observational Astronomy
- Observational astronomy offers opportunities to study variable stars and other objects such as quasars and BL lac objects. This is done with the 16' L X 200 Meade Telescope equipped with CCD camera.

c. Astrobiology
- Mud volcanoes and the pitch lake are studied as analog sites for Mars and Titan respectively as conditions for extremophiles.

(5) SOLAR ENERGY STUDIES

The design, construction and testing of low and high temperature flat plate collectors for use with
(i) Solar crop dryers and
(ii) Solar air conditioners, refrigerators and solar powered heat engines,
(iii) Solar timber dryers.
(iv) Solar water decontamination methods for rural areas.
(v) Solar Distillation
(vi) Materials for Photovoltaics
This area of research may be done as a joint effort with other departments.

(6) GEOTHERMAL ENERGY STUDIES

- Geophysical surveys - Resistivity and Seismic
- Methods of identification of fractured reservoirs
- Geothermal Heat Pumps

(7) EARTH MATERIALS STUDIES

- Various aspects of Mineralogy and Petrology of Trinidad and Tobago, including resources of the continental shelf.

(8) ENVIRONMENTAL PHYSICS

- Environmental monitoring with respect to sound and aerosols in certain work environment.
- Implications of sea surface temperatures for the Caribbean region in environmental studies.
- Climate change studies/modeling.
- Air pollution modeling (with respect to the regional industries).
- Solar water decontamination methods for rural areas.
- Lava flow problems (in collaboration with the Department of Mathematics and Seismic Research Unit).
- Wind potential assessments for Trinidad and Tobago.
- Rain erosivity determination.

(9) QUANTUM OPTICS

Quantum physics and solar energy technologies and medical technologies.

(10) FIBRE-OPTICS, OPTOELECTRONICS
Optoelectronics, fibre-optics and solar energy technologies and medical technologies.

(11) ELECTRONICS
- VLSI (Very Large Scale Integration) Implementation of Digital Signal Processing (DSP) Algorithms.
- Simulation and Design of Communication Systems.
- Design of Speech Recognition Systems.
- Design of Spectrum Analyzer
- Digital system Design using FPGA (Field Programmable Gate Array)

POSTGRADUATE COURSES IN PHYSICS

COURSE DESCRIPTIONS

SEMESTER: 2 (NOT OFFERED IN 2013/2014)
COURSE CODE: PHYS 6294
COURSE TITLE: NOVEL MATERIALS
NUMBER OF CREDITS: 3
PREREQUISTE: BSc (Physics, Chemistry, Chemical Engineering and/or permission of HOD, Physics)
COURSE DESCRIPTION: Superconductivity phenomenon, magnetic properties of superconductors, theories of high T_C superconductors, preparation techniques and composition features, applications of high T_C superconductors.

Fundamentals of nanotechnology, Nanotechnology in materials, ceramic nanomaterials, metal nanomaterials, polymeric nanomaterials, composite nanomaterials, synthesis of nanomaterials, nanotechnology in biomaterials, soft biomaterials, nanotubes, nanowires, applications of nanomaterials

Geometry of Nanoscale Carbon; Bonding, Dimensionality, Topology, Energetics, Fullerenes; Single and double walled Carbon Nanotubes, Synthesis of Single Wall Carbon Nanotubes; Diameter and Orientation Control and growth mechanisms, Selective Covalent Chemistry, applications of carbon nanotubes

Piezoelectric, Shape memory alloys and shape memory polymers, Magnetic shape memory alloys, pH-sensitive polymers, Temperature-responsive polymers, Halochromic materials, Chromogenic systems, Non-Newtonian fluid, applications of smart materials.
Assessment:

Coursework:	30%
Research Project:	70%

SEMESTER: 2
COURSE CODE: PHYS 6492
COURSE TITLE: DIGITAL SYSTEM DESIGN
NUMBER OF CREDITS: 3
PREREQUISTE: BSc Physics with Minors in Electronics/ Medical Physics and Bioengineering, BSc in Electrical and Computer Engineering, BSc in Computer Science / Math with PHYS2291 / PHYS3391 or permission of Head of Department.
COURSE DESCRIPTION: Various implementation technologies for digital systems and their comparison. Introduction to computer-aided design (CAD) tools for digital systems. Hardware description languages (HDLs). Custom and Semi-custom design flow. Xilinx's ISE Design Suite. Mentor Graphic's Design, Test and Verification Package, Matlab.

VHDL: Data objects. Classes and data types. Operators. Overloading. Entity and architecture declaration. Introduction to behavioral, dataflow and structural models. VHDL Statements: concurrent, sequential, assignment, process, conditional and case statements. Array and loops. Packages & libraries. Delays.

VHDL modeling and simulation of basic and advance combinational & sequential circuits. Design of Microcomputer: Basic components of a Microcomputer, Specifications, Architecture of a simple Microcomputer system, Design of a simple Microcomputer system using VHDL. Synthesis and optimization for cost, speed, power and chip recourse utilization tradeoffs.

Programmable logic devices: PROM (Programmable Read Only Memory), PAL (Programmable Array Logic), PLA (Programmable Logic Array), CPLD (***Complex Programmable Logic Device***) and FPGA (***Field Programmable Gate Array***). Xilinx's FPGA Design Flow. Digital system implementations using CPLDs and FPGAs. FPGA based implementation of various digital signal processing algorithms.
Assessment:

Theory Coursework	30%
Four Laboratory reports (equal weighting)	20%
One Major Design Project	50%

SEMESTER: 2
COURSE CODE: PHYS 6295
COURSE TITLE: SOLAR ENERGY CONVERSION
NUMBER OF CREDIT: 3
PREREQUISITES: BSC PHYSICS OR PERMISSION FROM HEAD OF DEPARTMENT.
RENEWABLE ENERGY
Solar Energy; Photovoltaics; Wind Energy; Hydroelectricity; Geothermal Energy; Ocean Thermal Energy Conversion; Wave Energy; Hydrogen; Fuel Cells; Biomass.

SOLAR ENERGY
Solar energy utilization; Solar radiation – Basic concepts, Geometric effects, Atmospheric effects, Solar spectrum, Solar insolation, Air mass; Solar; spectra, Spectral Energy distribution, Planck's formula, Spectral distribution of the solar constant, Wien's law, Stefan Boltzmann law; Flat plate collectors, selective surfaces; Design, construction and operating principles of a solar collector; Optical characteristics - Optics of collectors, Fresnel equations, Overall transmittance and reflectance for two polarization states, multiple glazings; Heat transfer across building walls; Heat transfer; characteristics; Efficiency of glazing/absorber system; Angular dependence of Solar Absorptance; Transmittance-Absorptance product; Radiation; exchange between surfaces; Mathematical analysis of a solar collector as applied to a selected unit; Concentrating Solar Power (CSP); Solar Cooling

PHOTOVOLTAICS (PV)
Photoelectric effect; Semi-conductor Physics; Materials used for PV cells; Photovoltaic cell, module, array; PV characteristics, characteristic curves; Factors influencing performance of PV cells; PV energy systems: components–generator, charge controller, battery and inverter; PV design, including Electrical and Mechanical design; Categories of PV modules: Cell types, Encapsulation materials, Substrate and Frame structure; Thin Films; Quantum Dot Nanotechnology; PV Grid connection; Modeling techniques: RETScreen Analysis; Economic analysis and applications; Socio-economic impacts of renewable energy education, dissemination and applications.
Assessment:
35 Hours of practical work, including Project. (Students must pass practical coursework).

Theory Coursework:	15%
Practical Coursework:	35%
(Practical experiments & Field Trip: 15% Research Project 20%)	
Final Examination: One 2 hour final paper	50%

MSc in Renewable Energy Technology (RET)

This master's programme is the result of an urgent need for the Caribbean region to become equipped in terms of building capacity in technologies which will support protection of the environment and also meet the challenges of escalating price and availability of fossil fuels and their use. The emphasis in this master's programme is on providing new graduates and persons already working in various sectors of the economy, with professional training and education in renewable energy technologies. The programme will provide expertise in these areas which will help to build capacity in the region and open possibilities for further study and research.

Aims and Objectives
This programme is intended to meet the needs of a broad range of professionals whose occupations are related to science and energy, and sustainable development. Included will be natural scientists, engineers and technical-related professionals, as well as those from the social sciences such as administrators. This programme is an entirely new programme, consisting of new and existing courses.

Admissions Criteria
B.Sc. Science degree.
Students normally would be required to have an Upper Second Class Honours degree in Physics, Mathematics or Engineering. Other qualifying students with a first degree would be required to undergo the Preliminary Study. Students must complete and pass this not-for-credit preparatory course prior to the first semester.

Course of Study
All students must take 8 compulsory courses worth 24 credits, 4 elective courses worth 12 credits, and a 9-credit Final Research Project – for a total of 45 credits.

Programme Content
The courses for the programme are listed below, with the eight (8) compulsory courses. Students will also be required to complete four (4) courses from the list of six (6) Elective courses, as well as the 9-credit Research Project course. The Core and Elective courses, together with the Research Project, total 45 credits.

COURSE LISTING

Core Compulsory (8 courses – 24 credits)
Semester I

RENT 6001	Energy Economics	3 credits
RENT 6002	Shaping Sustainable Energy Systems	3 credits
RENT 6004	Solar Energy Conversion	3 credits
RENT 6005	Wind Energy I	3 credits
RENT 6006	Bioenergy I	3 credits
RENT 6007	Energy Use and Energy Auditing	3 credits

Semester II

RENT 6003	Programme and Project Management	3 credits
RENT 6008	Electrical Integration of Renewables	3 credits

Electives (4 courses – 12 credits)
Semester II

RENT 6009	Hydro and Marine Power	3 credits
RENT 6010	Geothermal Energy	3 credits
RENT 6011	Energy Storage	3 credits
RENT 6012	Advanced Solar Energy	3 credits
RENT 6013	Wind Energy II	3 credits
RENT 6014	Bioenergy II	3 credits
RENT 6000	Research Project	9 credits
	Three months work + Presentation and Report	

COURSE DESCRIPTIONS

SEMESTER: 1
COURSE CODE: RENT 6001
COURSE TITLE: ENERGY ECONOMICS
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: Students will receive basic insights into the field of energy economics. They will learn about the different markets supplying energy and the different sectors demanding energy. An understanding of the limitations of non-renewable energy sources and the problems of their substitution by renewable energy sources will be gained. The special aspects of grid based energy markets will be discussed. At the end of the course each student should be able to understand the basic concepts of the different energy markets and the possible contributions of the different energy sources to a sustainable energy supply.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 1
COURSE CODE: RENT 6002
COURSE TITLE: SHAPING SUSTAINABLE ENERGY SYSTEMS
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: Sustainable Development is the framework within which RenewableEnergy Management must be placed. The long-term goal of the MSc Renewable Energy Technology is to equip participants with the technical expertise so they can implement projects which promote self-sufficiency and sustainable development of the region.

In this course, students will learn to differentiate between the competing models of sustainable development and to identify the major requirements and barriers to sustainable development of the energy system.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6003
COURSE TITLE: PROGRAMME AND PROJECT MANAGEMENT
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: The course is aligned to International Standards with the concepts and terminology as prescribed by Project Management Institute (PMI) Guide to Project Management Body of Knowledge (PMBOK) Guide. It covers the five essential project management process groups of initiating, planning, executing, controlling and closing projects. Participants will gain an understanding of the tools and techniques that can be applied to each phase of a project.

In both public and private sectors, there is an increased focus on managing projects to achieve a product/service of requisite quality, and to deliver that product/service within the approved budget and schedule. This course will provide a broad overview of the concepts and practices used managing projects in today's business environment.
Assessment

Coursework	40%
Final Exam	60%

SEMESTER: 1
COURSE CODE: RENT 6005
COURSE TITLE: WIND ENERGY I
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: This course explores the fundamental aspects of the wind resource, wind turbine aerodynamics and control, along with institutional and environmental aspects (including planning issues). An integral part of the course is a computer-based laboratory to provide hands-on experience in the design and optimisation of a wind farm. This course will also include a field trip to wind turbine site to allow the student to appreciate wind power in the real world.

Development of indigenous, renewable energy resources is critical in the drive to reduce energy cost and achieve energy security in the region. Wind power plays an important role in this movement since the wind resource in many parts of the Caribbean is favourable for wind energy development. Whether large, medium or small-scale, wind power is set to play a major part in the future energy mix of the Caribbean. Wind power technology is an interdisciplinary subject which must complement the other electricity generation methods.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 1
COURSE CODE: RENT 6006
COURSE TITLE: BIOENERGY I
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: Humans have used Bioenergy for thousands of years. It is still the most widely used form of renewable energy. In this course students will be introduced to the fundamental concepts of what biomass is, its role in nature and for human societies, in which way it is used sustainably, how it can be converted to energy and how certain biofuel technologies can help with waste management. Bioenergy encompasses many different sources including energy crops, agricultural waste, domestic waste and animal waste, all of which are plentiful across the Caribbean region. Case studies are presented that show current practices across the Caribbean.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6007
COURSE TITLE: ENERGY USE AND ENERGY AUDITING
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: This course is designed to enable students to assess the energy efficiency of small and medium premises, carry out energy audits and propose appropriate energy saving measures. The course comprises lectures, moderated working sessions and group exercises designed to allow the students to put the knowledge gained into practice. The whole development of Renewable Energy stems from the need to develop renewable indigenous resources and to eliminate or reduce the use of fossil fuels in the generation of electricity. This thrust can be enhanced by the efficient use of energy. An initial step is the assessment of existing systems and the introduction of energy efficient schemes. This alone can significantly reduce the electricity demand, and this must be a first step towards self sufficiency and energy security
Assessment:

Coursework	100%

SEMESTER: 2
COURSE CODE: RENT 6008
COURSE TITLE: ELECTRICAL INTEGRATION OF RENEWABLES
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: The integration of generators powered from renewable energy sources is fundamentally similar to that of fossil-fuelled generators and is based on the same principles; but, renewable energy sources are often intermittent and dispersed (large numbers of relatively small generators) and these factors must be considered. This module applies the well-established principles of electrical engineering to the subject of integrating generators powered from renewable energy sources into electrical power systems, small and large.

Electrical integration of renewable energy is often the overlooked, but is a crucial aspect of the renewable energy field. It is very common to convert energy from a renewable source into electricity. The same, of course, is true of energy from fossil fuels and the simple reason is that electricity is very convenient both to transport and to utilise. That said the design of the electrical system is rarely trivial. The proper integration of any electrical generator into an electrical power system requires knowledge of the well-established principles of electrical engineering. This course provides this very important aspect of the development of renewable energy.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6009
COURSE TITLE: HYDRO AND MARINE POWER
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: In this module the principles surrounding the generation of electricity from water will be examined. River, wave and ocean thermal resources are studied, as well as planning and environmental issues. Turbine and generator system design forms a major theme in this module as well as the thermal dynamics of ocean thermal technologies.

The Caribbean has unexplored potential for hydropower and various forms of marine power (wave and ocean thermal in particular). However there are few persons in the region with the necessary knowledge and skills to engage in the development of these resources. This course will provide the initial knowledge and skills base to help jump-start the development of the resources.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6010
COURSE TITLE: GEOTHERMAL ENERGY
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: This course provides an overview of geothermal energy systems. An integral part of the course is the Field Trip where students gain first hand information about different methods of measuring resistivity using equipment such as the MiniSting or the SuperSting. Field trips to specific Geothermal sites would help reinforce student understanding of the dynamic interaction of hydrothermal systems.

Many of the Caribbean islands have significant geothermal energy potential but limited technical resources in terms of trained personnel. It is therefore necessary to train persons in this area to satisfy the demands of the region in developing the science and technology of geothermal energy. This course will provide initially the necessary knowledge and skills to engage in the development of geothermal energy.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6011
COURSE TITLE: ENERGY STORAGE
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: A major part of this course will involve investigation of the hydrogen economy and hydrogen fuel cells. Inter-island energy transportation through a Caribbean wide super grid will also be discussed as well as small-scale energy storage options.

In order for renewable energy to meet consumer demand, energy storage will become more important as grid penetration increases. Therefore this course will explore the functioning, properties, and application of physical-chemical energy storage systems.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6014
COURSE TITLE: BIOENERGY II
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: Building on from knowledge gained in Bioenergy I, this module aims to cover in detail the production of energy from waste, of alcohols from micro-organisms and micro-algal systems and to cover in detail the topic of advanced conversion technologies such as pyrolysis and gasification and of special heat engines suited to the use of fuels derived from biomass/waste. A closer look at anaerobic biodigesters is performed, an area of potential benefit to the treatment of human and agricultural wastes. The principles underlying: alcohol production, energy extraction from waste, gasification, pyrolysis and the cycles of engines designed to run on fuels from biomass are covered in depth throughout this module. Students wishing to further specialize in this area will have the option of taking this course which further develops some of the topics in the first Bioenergy course and goes in-depth into the science of waste-to-energy production.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6013
COURSE TITLE: WIND ENERGY II
CREDITS: 3
PREREQUISITE: RENT 6005
COURSE DESCRIPTION: Building on wind energy I, this module aims to cover in depth (a) the advanced statistics and modeling of the resource necessary for precise assessment, (b) the aerodynamics and mechanics necessary for the design and stressing of wind turbines. Small-scale systems, electrical aspects, noise generation and offshore systems are also covered. The highlight of this course will be a wind tunnel based laboratory investigating the loading of a small-scale wind turbine.

Students who wish to further specialize in Wind Energy technology will have the option of taking this course which expands and delves further into the technology, and modeling and setting up of a wind farm.
Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 1
COURSE CODE: RENT 6004
COURSE TITLE: SOLAR ENERGY CONVERSION
CREDITS: 3
PREREQUISITE:
COURSE DESCRIPTION: Solar Energy is the basis for other forms of renewable energy. This course therefore starts by briefly describing the main forms of renewable energy and then delves into solar energy radiation and utilisation. It describes the solar spectra and active and passive solar systems. The heat transfer characteristics are investigated and methods of estimating efficiency are outlined.

The course introduces photovoltaics (PV) and the science of the photoelectric effect. PV characteristics are defined and PV design, categories of PV modules, grid connection issues and economic analysis are explained.

Assessment

Coursework	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6012
COURSE TITLE: ADVANCED SOLAR ENERGY
CREDITS: 3
PREREQUISITE: RENT 6004
COURSE DESCRIPTION: Building on Solar Energy Conversion, this module aims to cover in considerable depth (a) the semiconductor physics and technology involved in the design and manufacture of state of the art photovoltaic devices, (b) the design of photovoltaic components and systems, (c) advanced solar energy applications.

This will enable students to design simple PV systems, incorporating power tracking, and solar thermal systems. The module will also enable students to gain an understanding of the technology and economics of the manufacturing processes associated with the production of PV cells. One of the highlights of the course will be the design and analysis of a PV system by students via a software based laboratory.

Assessment

Course-work	50%
Final Exam	50%

SEMESTER: 2
COURSE CODE: RENT 6000
COURSE TITLE: RESEARCH PROJECT
CREDITS: 9
PREREQUISITE:
COURSE DESCRIPTION: The aim of the research project is to allow the student to synthesise and articulate several aspects of the taught programme within a single themed research topic. In addition, it will provide the opportunity for further detailed skills training in aspects of renewable energy technology. It will also allow the student to pursue an individual course of study on a particular research topic or issue of interest to the student and will incorporate technical skills training specific to the individual student. As such, the research project will provide the opportunity to develop a specific set of practical and reporting skills that will be invaluable to the student in his/her future career.

A Research Project is a fundamental component of the MSc programme and this is reflected, not only in the credit weighting, but by the fact that the research project runs for a six-month period so that the student may have the necessary time to produce a project of a high standard.

Assessment

Oral Presentation of Research Project	10%
Research Proposal and Methodology	30%
Research Thesis Report	60%

Postgraduate Course in "SCIENTIFIC PRESENTATION AND CRITIQUE"

COURSE LISTING

MPhil

GRSM 7004	Scientific Presentation and Critique 1
GRSM 7005	Scientific Presentation and Critique 2
GRSM 7006	Scientific Presentation and Critique 3

PhD

GRSM 8004	Scientific Presentation and Critique 1
GRSM 8005	Scientific Presentation and Critique 2
GRSM 8006	Scientific Presentation and Critique 3

COURSE DESCRIPTIONS

COURSE CODE: GRSM 7004 OR 8004
COURSE TITLE: SCIENTIFIC PRESENTATION & CRITIQUE 1
COURSE DESCRIPTION: This **year long 1-credit course** will be conducted within the context of departmental seminars presented once a week by academic staff and graduate students and visitors. Students will be assessed on (1) presentation and critique of recently published scientific papers (2) presentation of their own work in progress (3) critique of seminars presented by other graduate students, academic staff and invited external speakers to the Faculty / UWI and (4) attendance at these seminars. **There are no pre-requisites.** This course is recommended for all MPhil. and PhD. students in the Faculty of Science and Agriculture.

COURSE CODE: GRSM 7005 OR 8005
COURSE TITLE: SCIENTIFIC PRESENTATION & CRITIQUE 2
COURSE DESCRIPTION: Students will be expected to have already completed **GRSM 7004 OR GRSM 8004** or received credit for the course before registering for this course. This **year long 1-credit course** will be conducted as for **GRSM 7005 or 8005** but the assessment will require a higher standard of performance from the students in the areas (1) to (3) above. This course is recommended for all MPhil and PhD students in the Faculty.

COURSE CODE: GRSM 7006 OR 8006
COURSE TITLE: SCIENTIFIC PRESENTATION & CRITIQUE 3
COURSE DESCRIPTION: Students may register for a third course, **GRSM 7006 or 8006**, after completing both **GRSM 7004 or 8004** and **GRSM 7005 or 8005** or receiving credit for them. This **year long 1-credit course** will be conducted as for the two previous courses above but assessment will require a higher level of performance than for **GRSM 7005 or 8005**. This course is recommended for all PhD students in the Faculty.

PURPOSE OF THE COURSES

These courses are designed for MPhil and PhD students. Its purpose is to:

- Immerse graduate students into a culture of reading and critical analysis of research in their field and related disciplines.
- Expose students to a broad range of research topics in and related to their discipline.
- Involve students in regular scientific discourse involving their own work and the work of others.
- Develop students' analytical and critical thinking skills as well as their oral presentation and writing skills.

NOTE: Current regulations of the School of Graduate Studies and Research state that MPhil students are required to present two assessed seminars and PhD students must present three. This course may be used as a forum for these presentations which will be assessed in the manner prescribed for such "assessed seminars".

Instructor information
Name of instructor(s):
Faculty co-ordinator (course co-ordinator;)
Departmental co-ordinators.

NOTE: The course co-ordinator is the first examiner and has overall responsibility for the course. Department co-ordinators will be responsible for scheduling of their department's seminars and journal club sessions, recording student attendance and for assessment and evaluation of students attending their sessions.

Office hours:
To be advised

Communication policy:
Email is the preferred method of contact.

Content:
The course will consist of research seminars presented once a week by academic staff and graduate students. Students will also meet at least every other week in groups in which by schedule there will be a presentation by a student of a journal article for discussion.
Students will be assessed by a panel of staff chosen from the department involved on (1) presentation and critique of recent scientific papers (2) presentation and defence of their own work in progress and (3) critique of seminars presented by other graduate students, academic staff and invited external speakers to the Faculty / UWI. Students will also be required to attend library workshops covering topics including general library skills, effective use of online resources, academic writing styles, critique of scientific papers.

Format:
Each research seminar / group meeting session will last about 1 hr including a question and answer period at the end of the presentation. In general, presentations will be approximately 30 minutes followed by questions/ discussion. For student presentations, the last 15 minutes may be used for further questioning by assessing panel, for targeted discussion, feedback on performance and past assignments from the assessors.

Students will be encouraged to attend as many seminars as possible, even when the topic may seem unrelated to their research as exposure to current research in areas that are not directly related to their own research is an excellent means of broadening their knowledge base. *Students may attend seminars in departments other than their own but must make prior arrangements with the relevant facilitator to ensure that their attendance is recorded and they are appropriately assessed.*

Goals / Aims
The aim of the course is to broaden graduate students' knowledge base while developing their analytical, critical thinking and presentation skills. It also aims to encourage students to reflect on their own research work, and to engage in peer review and scientific discourse.

Topic or Unit Objectives
At the end of this course students will be able to:

- effectively present their own research and the work of other scientists, accurately identify, summarise and critically assess the research question(s), hypotheses, methodology, results, analysis of results and conclusions arrived at from both written and orally presented research work, respond appropriately to questions raised about their own work.

Assignments
Paper Summaries: In the group seminars when students are presenting a journal article for discussion, the paper should have appeared in (or have been accepted to) a peer-reviewed journal and should be technically rigorous for the field. Thus papers published in magazines will generally be inappropriate. The selected paper will be circulated amongst students one week in advance of the presentation and students will be asked to read it and prepare a paper summary as outlined below. Paper summaries can also be prepared on publications by invited speakers prior to the seminar, in which case each student will be responsible for selecting a paper by the relevant speaker.

To receive credit for a paper summary, it must be submitted before the relevant presentation starts. Each paper summary will receive a grade of 1, 2 or 3. Grades of 2 or 3 are required to receive credit for it towards the 5 required summaries (see assessment below). The paper summary should be 1 - 2 pages in length and should include the labeled sections listed below:

- ***Paper Bibliography Information:***
  Title, author(s), where and when published, etc.

- ***Problem Statement:***
  Identify the research question in the paper and why it is significant.

- ***Hypothesis / Hypotheses:***
  State the main hypothesis / hypotheses being tested.

- ***Scientific Approach:***
  Describe the methods used or the analyses completed by the author(s).

- ***Results:***
  Summarize the major results of the paper.

- ***Critique:***
  Comment on the elements above, on the analysis of the results, the validity of the conclusions reached, whether the results support the hypothesis or not and whether there are alternative hypotheses that might account for the results. Also note aspects that could be improved (and note how), identify open issues that relate to the problem area but are not addressed in the paper, etc.

The goal of the one-page summaries is to allow students to become familiar with the topic of the presentation prior to the presentation. This will enable them to better understand the talk and will give them time to formulate questions. It also develops their analytical and critical thinking skills. Students will be encouraged to discuss a given paper with other students in the course for better understanding of the paper content; each student, however, will be required to write an independent paper summary.

- ***Seminar reports:***
  To receive credit for attending a seminar based on on-going research by graduate students, academic staff or visiting lecturers (as opposed to the journal club format described above), students will be required to complete a seminar report on a form that will be available at the beginning of the seminar. The forms may vary from one session to the next but will generally include questions designed to confirm whether students were actively engaged in the sessions (eg. the student might be asked to state the objectives of the work presented, to state the main hypothesis, or to comment of the methodological approach used). The completed forms will be due at the conclusion of the seminar (after the question and answer session).

If a student misses a seminar for a valid reason they may be allowed to submit a make-up report e.g. a 2-page paper on the topic of the seminar missed. However this is entirely at the discretion of the departmental co-ordinator.

Assessment
Assessment will be Pass / Fail. To receive credit for this course students will have to satisfy all of the following requirements:

A minimum of 75% attendance at seminars (incl. group meetings).

Students will have to stay for the full hour or until the discussion is completed (which ever is shorter) in order to be credited with attendance. They are also expected to refrain from activities such as doing other work, reading or sleeping during sessions. Those exhibiting such behaviour will not receive credit for attending that seminar. Seminar reports (see below) will be used as evidence of attendance, so students must complete one for each seminar attended.

Pass grades for at least 5 seminar reports.

Each seminar report will receive a grade of 1, 2 or 3. Only those with grades of 2 or 3 will count towards the required reports.

Pass grades for at least 5 paper summaries.

Each paper summary will receive a grade of 1, 2 or 3. Only summaries that receive grades of 2 or 3 will count towards the 5 required summaries.

Satisfactory presentation of at least one seminar and one published research paper.
One seminar should be on their research proposal / the progress of their own work / thesis outline (depending on the stage of their work) and the other should be a presentation of a paper from a peer-reviewed journal. Student presentations will receive a grades of 1, 2 or 3 and only grade 2 and 3 will be credited.

Evaluation
Evaluation is on the basis of continuous assessment (as described above). There is no final examination associated with this course.

Teaching strategies
Seminars, Group discussion, Self-directed learning, Individual consultation.

Resources
Articles from peer-reviewed scientific journals in the chemistry or related fields. Although these will primarily be journals to which the UWI subscribes, pay-per-view purchase of some articles will occasionally be required.

Readings
The readings will be articles from peer-reviewed scientific journals and will vary depending on the seminar topics. Students may also need to consult relevant textbooks.

Course Calendar
The courses will be year-long (2 semesters) with sessions held every week (alternating journal club and research seminars).
Seminar topics and relevant papers will be circulated at least a week in advance.
Paper summaries will be due on the day of the relevant journal club prior to the beginning of the session.
Seminar reports will be due on the day of the relevant seminar at the end of the question and answer session.

NOTE: Students are responsible for checking the seminar schedule and their email for up to date information including on the scheduled date for the seminar as sometimes seminars will be announced / cancelled at the last moment.

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