DEPARTMENT OF LIFE SCIENCES

Programme Handbook

2014/2015 Academic Year

Excerpt from
the Faculty of Science & Technology
Handbook

Contents

These courses are **not available for the 2014/2015 Academic Year.

DEPARTMENT OF LIFE SCIENCES

PROGRAMME OVERVIEW
2014/15 Academic Year

The Department of Life Sciences curriculum structure (as listed below) includes: two complete BSc programmes, five single majors and four minors. The Biology with Education Option has been revised and is still being offered as part of the list of Options offered by the Faculty. Having revised the BSc Programmes, Majors and Minors in the 2010/11 Academic Year, presented new second year courses in the 2011/12 Academic Year and new final year courses for 2012/2013, the curriculum remains essentially unchanged for the 2014/15 academic year, with a few revisions.

The BSc Programmes, Majors and Minors offered by the Department of Life Sciences are as follows:

BSC PROGRAMMES

1. BSc Environmental Biology »
2. BSc Experimental Biology »

MAJORS

3. Major in Animal Biology »
4. Major in Horticulture »
5. Major in Marine Biology »
6. Major in Plant Biology »
7. Major in Terrestrial and Freshwater Ecology »

MINORS

8. Minor in Animal Biology »
9. Minor in Coastal Ecosystems »
10. Minor in Plant Biology »
11. Minor in Terrestrial and Freshwater Ecology »

OPTION

12. Option: Biology with Education »

DEPARTMENT OF LIFE SCIENCES

LIST OF UNDERGRADUATE COURSES
2014/15 Academic Year

CODES	TITLES	CREDIT	SEMESTER OFFERED	Level	PREREQUISITES
PRELIMINARY LEVEL more details					
BIOL0011	**PRELIMINARY BIOLOGY I**	6-P Credits	Semester 1	0	CSEC Biology or equivalent
BIOL0012	**PRELIMINARY BIOLOGY II**	6-P Credits	Semester 2	0	CSEC Biology or equivalent
LEVEL 1 more details					
BIOL1017	**CELL BIOLOGY**	3 Credits	Semester 1	1	*A pass in one of the following:* Preliminary Biology I and II (BL05A/BIOL0011 and BL05B/BIOL0012) **OR** CAPE Units 1 & 2 ('A' level) Biology **or** equivalent
AND					
BIOL1018	**MOLECULAR BIOLOGY AND GENETICS**	3 Credits			
BIOL1262	**LIVING ORGANISMS I:** Bacteria, Plant-like Protists and Plants	3 Credits	Semester 2	1	*A pass in one of the following:* Preliminary Biology I and II (BL05A/BIOL0011 and BL05B/BIOL0012) **OR** CAPE Units 1 & 2 ('A' level) Biology **or** equivalent
AND					
BIOL1263	**LIVING ORGANISMS II:** Fungi, Animal-like Protists and Animals	3 Credits			

LEVELS 2 & 3

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

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

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

LEVEL 2 COURSES

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

view details

Duration	6-Week Courses	6-Week Courses	12 Week Courses
Semester 1 **Weeks 1-6**	BOTN2401- Plant Form and Systematics	BIOL2407- Biological Evolution	**BIOL2401- Research Skills and Practices in Biology**
Semester 1 **Weeks 7-12**	BIOL2406- Eukaryotic Microbiology	BIOL2402- Fundamentals of Biometry	
Semester 2 **Weeks 1-6**	BIOL2404- Molecular & Population Genetics	ZOOL2403- Maintenance Systems in Animals	**BIOL2403- Principles of Ecology**
Semester 2 **Weeks 7-12**	BOTN2402- Physiology of Plants	ZOOL2404- Coordination and Control in Animals	
Summer School only	BIOL2408- Diving for Scientists		

Courses in **bold font** are core to all Life Sciences Programmes, Majors and Minors.

LEVEL 3 COURSES

(Available as of 2014/15 Academic Year)

more details

A1 Tues/Thurs[#] Mon/Fri	A2 Tues/Thurs Mon/Fri	B1 Friday/ Monday	B2 Friday/ Monday	C1 Monday	C2 Mon/ Fri	EVENINGS Tues/Wed
BOTN3405 Plant Eco-Physiology	**ZOOL3407** Human Biology	**ZOOL3403** Entomology	**ZOOL3409** Aquaculture	**BIOL3407** Oceanography	**BIOL3403** The Biology of Soil	**AGSL2401** Management of Soils
BOTN3402 Plant Breeding	**ZOOL3405** Vertebrate Biology	**ZOOL3404** Parasitology	**BOTN3406** Tropical Forest Ecology	**BIOL3408** Coastal Ecosystems	**BOTN3403** Fundamentals of Horticulture	**AGSL3001** Irrigation and Drainage Techniques
TBA	**ZOOL2402** Animal Physiology	**ZOOL3406** Immunology	**BIOL3406** Freshwater Biology	**ZOOL3408** Sustainable Use of Marine Fishable Resources	**BIOL3404** Virology	**AGCP3407** Postharvest Technologies
BOTN3401 Principles of Plant Biotechnology	**BIOL3410** Water Pollution Biology	**BIOL3405** Pest Ecology and Management	**BIOL3400** Issues in Conservation Biology	**BIOL3409** Caribbean Coral Reefs	**BOTN3404** Economic Botany	**AGCP3406** Tropical Fruit Crop Production

EVENING SCHEDULE (AG COURSES)**
L1, L2 – Monday 5 – 7p.m ; L3 – Thursday 5 – 6p.m.
Tutorial – Thursday 6 - 7 p.m.
Practical 1 – Tuesday 5 - 8 p.m.
Practical 2 – Wednesday 5 - 8 p.m.

ZOOL3410 Advanced Topics in Animal Science
Schedule: Mondays 5:30 – 7:30p.m., Wednesdays 5:30 – 6:30p.m.

Internship and Research Project Courses
AGBU3008 – Internship
AGBU3012 – Research Project
BIOL3412 – Internship
BIOL3413 – Biology Project

[#]Underlined day(s) : Stream 1 Lab session(s)

PROGRAMME DESCRIPTIONS

BSC IN ENVIRONMENTAL BIOLOGY (63 Advanced Credits)

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

Programme Outline: Modified for 2012/13.
The **BSc in Environmental Biology** cannot be taken with any other major or minor because of the number of credits required which are as follows:

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

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

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

- BIOL2401 Research Skills and Practices in Biology
- BIOL2402 Fundamentals of Biometry
- BIOL2403 Principles of Ecology
- BIOL2404 Molecular & Population Genetics
- BIOL2406 Eukaryotic Microbiology
- BIOL2407 Biological Evolution
- BOTN2401 Plant Diversity and Systematics
- BOTN2402 Physiology of Plants
- ZOOL2403 Maintenance Systems in Animals
- ZOOL2404 Coordination and Control in Animals

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

- AGCP3405 Landscape and Turf Grass Production
- BIOL3400 Issues in Conservation Biology
- BIOL3406 Freshwater Biology
- BIOL3407 Oceanography
- BIOL3408 Coastal Ecosystems
- BIOL3409 Caribbean Coral Reefs
- BOTN3405 Plant Eco-Physiology
- BOTN3406 Tropical Forest Ecology
- ZOOL3403 Entomology
- ZOOL3408 Sustainable use of Marine Fishable Resources
- ZOOL3409 Aquaculture
- BIOL3412 Internship

  OR
- BIOL3413 Biology Project

Students must complete either the Biology Project or the Internship.

BSC IN EXPERIMENTAL BIOLOGY (63 Advanced Credits)

Programme Overview
The BSc in Experimental Biology was previously offered as an option in Experimental Biology. It is designed to expose students to a wide range of laboratory-based courses which reflect the variety of specializations available within the subject of Biology. These include areas as diverse as Plant Biotechnology, Parasitology and Vertebrate Biology. The programme is intended to appeal to those students seeking a degree which emphasizes a laboratory-based experimental approach to Biology with concomitant expertise in a wide range of laboratory techniques. The new design of the programme presented here encourages students to combine courses from the three main areas of Biology: Animal Biology, Plant Biology and the Biology of Microbes.

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

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

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

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

Level 2: A total of 30 credits

- BIOL2401 Research Skills and Practices in Biology
- BIOL2402 Fundamentals of Biometry
- BIOL2403 Principles of Ecology
- BIOL2404 Molecular & Population Genetics
- BIOL2406 Eukaryotic Microbiology
- BIOL2407 Biological Evolution
- BOTN2401 Plant Diversity and Systematics
- BOTN2402 Physiology of Plants
- ZOOL2403 Maintenance Systems in Animals
- ZOOL2404 Coordination and Control in Animals

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

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

**Course not offered this academic year

MAJOR IN ANIMAL BIOLOGY (39 Advanced Credits)

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

Programme Outline

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

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

Level 2
A minimum of 21 credits which must include:

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

Level 3
A minimum of 18 credits which must include:

- BIOL3400 Issues in Conservation Biology
- ZOOL3403 Entomology
- ZOOL3404 Parasitology
- ZOOL3406 Immunology
- ZOOL3407 Human Biology
- ZOOL3410 Advanced Topics in Animal Science

Plus 3 credits from any of the following:

BIOL3404	Virology
BIOL3405	Pest Ecology and Management
ZOOL3406	Immunology

MINOR IN ANIMAL BIOLOGY (15 Advanced Credits)

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

Programme Outline

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

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

Level 2
6 credits as follows:

- ZOOL2403 Maintenance Systems in Animals
- ZOOL2404 Coordination and Control in Animals

Level 3
9 credits from the following:

- BIOL3405 Pest Ecology & Management
- ZOOL2402 Animal Physiology
- ZOOL3403 Entomology
- ZOOL3404 Parasitology
- ZOOL3405 Vertebrate Biology
- ZOOL3406 Immunology

MINOR IN COASTAL ECOSYSTEMS (18 Advanced Credits)

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

Programme Outline

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

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

Level 2
9 credits as follows:

- BIOL2403 Principles of Ecology
- BIOL2406 Eukaryotic Microorganisms
- BOTN2402 Physiology of Plants

Level 3
9 credits as follows:

- BOTN3405 Plant Eco-Physiology
- BIOL3408 Coastal Ecosystems
- BIOL3409 Caribbean Coral Reefs

MAJOR IN HORTICULTURE (42 Advanced Credits)

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

Programme Outline

Level 1
12 credits as follows:

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

A total of **42** Advanced credits from Part II (Levels 2 & 3) which must include:

Level 2
18 credits from list below

- **AGSL2401 Management of Soils**
- BIOL2401 Research Skills and Practices in Biology
- BIOL2402 Fundamentals of Biometry

- BIOL2403 Principles of Ecology
- BIOL2404 Molecular and Population Genetics
- BOTN2401 Plant Form and Systematics
- BOTN2402 Physiology of Plants

Level 3
21 credits chosen from the list below (AG** courses are compulsory)

- **AGBU3008 Agriculture Internship** (4 cr.)
- **AGBU3012 Research Project** (4 cr.)
- **AGCP3405 Landscape and Turf Grass Production**
- **AGCP3406 Fruit Crop Production**
- **AGCP3407 Postharvest Technologies**
- BIOL3405 Pest Ecology and Management
- BOTN3402 Plant Breeding
- BOTN3403 Fundamentals of Horticulture

Courses in bold are unique to this major and compulsory.

MAJOR IN MARINE BIOLOGY (39 Advanced Credits)

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

Programme Outline

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

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

Level 2
A minimum of 21 credits which must include:

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

Level 3
A minimum of 18 credits which must include:

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

Plus 3 credits from any of the following:

- BIOL3410 Water Pollution Biology
- ZOOL3405 Vertebrate Biology

The following companion courses are strongly recommended:

- BIOL2408 Diving for Scientists
- BIOL3412 Internship
- BIOL3413 Biology Project

MAJOR IN PLANT BIOLOGY (39 Advanced Credits)

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

Programme Outline

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

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

Level 2
A minimum of 18 credits which must include:

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

Level 3
A minimum of 21 credits which must include:

- BIOL3403 The Biology of Soil
- BOTN3401 Principles of Plant Biotechnology
- BOTN3402 Plant Breeding
- BOTN3404 Economic Botany
- BOTN3405 Plant Eco-Physiology

Plus 6 credits from any of the following:

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

MINOR IN PLANT BIOLOGY (15 Advanced Credits)

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

Programme Outline

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

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

Level 2
9 credits as follows:

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

Level 3
6 credits from the following:

- BOTN3401 Principles of Plant Biotechnology
- BOTN3402 Plant Breeding
- BOTN3403 Fundamentals of Horticulture
- BOTN3404 Economic Botany
- BOTN3405 Plant Eco-Physiology

MAJOR IN TERRESTRIAL AND FRESHWATER ECOLOGY (39 Advanced credits)

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

Programme Outline

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

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

Level 2
A minimum of 21 credits which must include:

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

Level 3
A minimum of 18 credits which must include:

- BIOL3400 Issues in Conservation Biology
- BIOL3406 Freshwater Biology
- BIOL3410 Water Pollution Biology
- BOTN3406 Tropical Forest Ecology
- ZOOL3403 Entomology

Plus 3 credits from any of the following:

- BIOL3403 The Biology of Soil
- BIOL3405 Pest Ecology & Management
- BOTN3405 Plant Eco-Physiology

MINOR IN TERRESTRIAL AND FRESHWATER ECOLOGY (15 Advanced credits)

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

Programme Outline

Level 1

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

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

Level 2
6 credits as follows:

- BIOL2403 Principles of Ecology
- BIOL2407 Biological Evolution

Level 3
9 credits as follows:

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

BIOLOGY WITH EDUCATION OPTION (63 advanced credits)

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

Programme Outline

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

Semester 1

- BIOL1017 Cell Biology
- BIOL1018 Molecular Biology and Genetics

Semester 2

- BIOL1262 Living Organisms I
- BIOL1263 Living Organisms II

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

Level 2: A total of **63** credits which must include:

Semester 1

- BIOL2401 Research Skills and Practices in Biology
- BIOL2402 Fundamentals of Biometry
- BIOL2405 Eukaryotic Microbiology
- BIOL2407 Biological Evolution
- BOTN2401 Plant Form and Systematics

Semester 2

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

(All Life Sciences Year 1 and 2 courses are worth 3 credits each)

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

DEPARTMENT OF LIFE SCIENCES
COURSE DESCRIPTIONS

PRELIMINARY COURSES
(Revised and presented for 2006/07 Academic Year)

BIOL0011 PRELIMINARY BIOLOGY I
(6 P-Credits) Semester 1 Level 0

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

Course Content**:**

Biological Techniques

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

Mode of Delivery:

- Lectures: 36 hours
- Tutorials: 12 hours
- Laboratory Exercises: 72 hours: involving experiments demonstrating biochemical and biological processes and principles; studies of living/fresh and preserved protist, fungi, plants and animals to demonstrate biodiversity.

Evaluation:

(Students are required to pass both components)

Final Examinations:		60%
One 2-hour theory paper	30%	
One 2-hour comprehensive paper	30%	
Coursework:		40%
One in-course theory test	6%	
Two in-course practical tests	24%	
Laboratory reports	10%	

BIOL0012 PRELIMINARY BIOLOGY II
(6 P-Credits) Semester 2 Level 0

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

Course Content:

Organisms and the environment

- Levels of Ecological Organisation
- Energy Flow
- Biogeochemical Cycles

Systems in plants and animals

- Plant Structure
- Transpiration, Translocation, Photosynthesis
- Animal structure
- Respiration, Transport, Nutrition
- Coordination and Control, Excretion and Osmoregulation
- Movement and Support
- Reproduction, Growth and Development

Mode of Delivery:

- Lectures: 36 hours
- Tutorials: 12 hours
- Laboratory Exercises: 72 hours: involving the study of living/fresh and preserved organisms and prepared slides to demonstrate the relationship between structure and function of the systems in plants and animals.

Evaluation:

(Students are required to pass both components)

Final Examinations:		60%
One 2-hour theory paper	30%	
One 2-hour comprehensive paper	30%	
Coursework:		40%
One in-course theory test	6%	
Two in-course practical tests	24%	
Laboratory reports	10%	

LEVEL 1 COURSES

Revised and presented as four 3-credit courses for 2010/11 Academic Year.

BIOL1017 CELL BIOLOGY

(3 credits) Semester 1 Level I

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

Course Content:

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

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

Microscopical techniques to study living and fixed cells

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

Practical Work:

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

Mode of Delivery:

Lectures:	18 contact hours/week	Didactic and interactive
Tutorials:	6 contact hours/week	Interactive
Practicals:	30 contact hours/week	Interactive, Self-directed

Evaluation:

(Students are required to pass both components)

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

BIOL1018 MOLECULAR BIOLOGY AND GENETICS
(3 credits) Semester 1 Level I

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

Course Content:

- **Molecular Biology**
  The nature of genes
  DNA replication
  Transcription
  Protein synthesis
  Control of gene expression
  PCR, cloning and DNA sequencing
- **Genetics**
  Mendelian inheritance
  Probability, binomial theorem and chi-square test
  Quantitative traits
  Linkage, crossing over and mapping
  Sex linkage and sex determination
  Gene frequencies in natural populations

- **Practical Work:**
  DNA isolation, restriction digestion and agarose electrophoresis
  Exercises on Mendelian crosses and gene frequencies

Mode of Delivery:

Lectures	18 contact hours	Didactic and interactive
Tutorials	6 contact hours	Interactive
Practicals	36 contact hours	Interactive, self-directed

Evaluation:
(Students are required to pass both components)

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

BIOL1262 LIVING ORGANISMS I
(3 credits) Semester 2 Level I

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

Course Content:

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

Practical Work:

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

Mode of Delivery:

Lectures	18 contact hours/week	Didactic and interactive
Tutorials	6 contact hours/week	Interactive/ problem-solving
Practicals	36 contact hours/week	Interactive, Self-directed

Evaluation:

(Students are required to pass both components)

Final Examination: 50%

One 2-hour Comprehensive paper

Course Work: 50%

Tutorial (writing across the curriculum exercises/quizzes)	10%
Laboratory reports (10 x 2% each = 20%)	20%
One in-course test	20%

BIOL1263 LIVING ORGANISMS II

(3 credits) Semester 2 Level I

Pre-requisites: A pass in:

Preliminary Biology I and II (BIOL0011 and BIOL0012); OR CAPE Biology (Units 1 and 2); OR equivalent training

Course Content:

- Origin of animals
- Evolution of diversity
- Classification and phylogeny of animals
- Ecological principles
- Animal-like protists
- Animal Architecture
- Invertebrate animals
- Vertebrate animals
- Major groups of fungi

Practical Work:

- Classification of animals
- Studies of the morphology of the main groups of animals and fungi
- Dissection of selected animals to show internal anatomy and evolutionary development of the taxonomic group
- Demonstrations of adaptive radiation of main groups of animals and fungi

Mode of Delivery:

Lectures	18 contact hours/week	Didactic and interactive
Tutorials	6 contact hours/week	Interactive/ problem-solving
Practicals	36 contact hours/week	Interactive, Self-directed

Evaluation:

(Students are required to pass both components)

Final Examination: 50%

One 2-hour Comprehensive paper

Course Work: 50%

Tutorial writing across the curriculum exercises/quizzes	10%
Laboratory reports (10 x 2% each = 20%)	20%
One in-course test	20%

LEVEL 2 COURSES

Revised and presented as 3-credit courses for the 2011/12 Academic Year

AGSL2401 MANAGEMENT OF SOILS

(3 credits) Semester 1 Level II

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

Course Description:

The course will cover the basics of soil properties and the effects of land management on these properties. Soil management to improve water properties, soil fertility, overall soil quality and to mitigate against soil erosion will be covered.

Content:

1. Soil basics- texture and structure;
2. methods of land clearing and their effects on soil structure;
3. soil tillage and the management of soil structure for plant growth;
4. management of soil structure to improve water intake, transmission and storage;
5. soil and crop water relations, water management for salinity control; soil erosion and the management of hillsides;
6. management of dry and wet lands;
7. management of forest soils; management of specific problem soils;
8. management for agriculture, soil management and its effects on microbes, microbial activity and soil fertility;
9. soil fertility management; soil quality, carbon sequestration;
10. soil management practices case studies.

Assessment Procedures/Methods:

(Students are required to pass both components)

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

Materials/Bibliography/Reading Lists:

Prescribed texts:

1. Brady, N.C. and Weil, R.R. (2008). The nature and properties of soils. (14th ed.). Upper saddle Rd., N.J. Pearson-Prentice Hall
2. Fangmeier, D. D.; Elliot, W.J. Workman, S.R. and Huffman, R.L. (Sep 26, 2009) 5th Ed. Soil and Water Conservation Engineering. Delmar Cengage Learning; ISBN-10: 9781401897499; ISBN-13: 978-1401897499
3. Schwab, G. O.; Fangmeier, D.D. and Elliot, W.J. 2001. Soil and Water Management Systems (9780471109730): Chichester- John Wiley and Sons. ISBN 0-471 5994 8

Internet resources:

http://afsic.nal.usda.gov/nal_display/index.php?info_center=2&tax_level=1&tax_subject=293
http://www.asareca.org/swmnet/home.php?LinkID=0c3c8322b833376d737f14a98a77d998
www.prenhall.com/brady
http://www.attra.com
http://www.fao.org/organicag

BIOL2401 RESEARCH SKILLS AND PRACTICES IN BIOLOGY

(3 Credits) Semester 1 Level II

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

Course description:

The course is designed to introduce students to 10 major topics related to Biological and Ethical skills that will equip students with a variety of practical and transferable skills in areas such as

team/group work, scientific report writing, oral presentations, study skills, basic laboratory skills, experimental design, data handling, display and interpretation, and basic statistical analysis.

Course Content:

This course will cover the following topics:

1. Transferable skills (time management, note taking, production of accurate illustrations of microscopic and macroscopic specimens, group dynamics and coordination of group activities)
2. Information technology and library resources
3. Bioethics: Plagiarism, fabrication and falsification of data
4. Scientific Communication
5. Laboratory techniques and procedures
6. Field work- approaches and procedures
7. Analytical skills
8. Collecting and identifying specimens
9. Manipulating and observing specimens
10. Basic analysis and presentation of data

Teaching Methods/Approaches:

Method/Approach	**Contact hours**	**Credit hours**
Formal Lectures:	18	18
Tutorials/Seminars:	6	6
Laboratory and Field work:	30	15
(inclusive of case study presentation and discussion)		
Total:	54	39

Assessment Procedures/Methods:

(Students are required to pass all components)

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

Materials/Bibliography/Reading List:

Jones, A., Reed, R. and Weyers, J. 4th Ed. 2007. Practical Skills in Biology. ISBN- 0-13-175509-9. Benjamin Cummings.

Online Resources:

www.ucl.ac.uk/keyskills/customised-pages/biology
http://oba.od.nih.gov/oba/about_oba.html), BioethicsResources@mail.nih.gov

BIOL2402 FUNDAMENTALS OF BIOMETRY

(3 credits) Semester 1 Level II

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

Rationale: This course is designed to provide a foundation in statistical concepts applicable to biological experiments.

Course Description:

The course begins with an overview of descriptive methods and tests for one and two variables, using biological examples and then introduces testing relationships between multiple variables.

Learning Outcomes:

Upon successful completion of this course the students should be able to:

- explain basic statistical concepts;
- summarise quantitative biological data using methods of descriptive statistics;
- based on specified criteria, identify appropriate statistical tests for one and two variables;

- apply statistical test procedures and interpret the results;
- describe relationships among multiple independent variables.

Content:

1. Data in Biology: types of variables; accuracy and significant figures; data management
2. Populations and Samples: statistical populations; the need for samples; sampling procedures
3. Descriptive Statistics: frequency distributions; measures of central tendency; measures of dispersion
4. The Normal Distribution: probability density functions; properties of the normal distribution; the distribution of sample means; confidence intervals
5. Statistical Hypothesis Testing: making decision about populations based on samples; null and alternative hypotheses; alpha and beta error
6. One-Sample Hypotheses: hypotheses concerning population parameters; testing goodness of fit
7. Testing the relationship between two variables: the nature of a statistical relationship; criteria used to select appropriate tests; overview of major tests
8. Applying tests for two variables: contingency tests; analysis of variance; regression and correlation; rank tests; multiple comparisons; assessing validity of statistical assumptions.
9. Tests for more than two variables: separating the influences of multiple independent variables on a dependent variable; statistical interaction

Teaching methods/Approaches:

Method/Approach	**Contact Hours**	**Credit Hours**
Formal Lectures	18	18
Tutorials	7	7
Practical work (exercises in solving statistical problems using a software application and by hand)	28	14
Total	53	39

Assessment Procedures/Methods:

(Students are required to pass both components)

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

Materials/Bibliography/Reading Lists

Prescribed texts:

Zar, J.H. 2009. Biostatistical analysis, 5th Ed. Prentice Hall ISBN: 013081542X.
Hinton, Perry R. 2004. Statistics Explained, 3rd Ed. Routledge. ISBN: 0415332850

BIOL2403 PRINCIPLES OF ECOLOGY

(3 Credits) Semester 2 Level II

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

Rationale: The discipline of ecology underpins and provides foundation for the study of the environment. The study of how organisms affect the transport and transformation of energy and matter in the biosphere helps us understand the principles of operation of the natural system which in turn provides useful models of sustainability.

Course Description:

The course is designed to introduce the scientific study of the interrelationships between and among organisms and between organisms and all aspects of the living and non-living environment.

Learning Objectives:

Upon successful completion of this course, students should be able to:

1. explain population distributions and the abiotic and biotic factors which influence them
2. identify species interactions and evaluate the interdependence of species
3. describe concepts of community productivity, succession, cycling and transformation

Content:

- Ecology and its domain
- Geographic range habitat and niche, abiotic and biotic environment
- Ecological role of abiotic factors (climatic and edaphic) on plant and animal populations Population performance along physical gradients
- Population structure and demography; population change over time, growth models, dispersal, life tables and resource allocation patterns
- Species interactions: competition, predation, herbivory, commensalism, ammensalism, protocooperation and mutualism
- Communities; community classification, concepts and attributes
- Island Communities
- Primary and secondary ecological succession
- Nutrient cycling and energy flow
- Primary and secondary production, trophic levels and ecological efficiency

Teaching Methods/Approaches:

Method/Approach	**Contact hours**	**Credit hours**
Formal Lectures:	21 hours	21
Tutorials/Seminars:	6 hours	6
Laboratory and Field work:	24 hours	12
(inclusive of case study presentation and discussion)		
Total:	51 hours	39 hours

Assessment Procedures/Methods:

(Students are required to pass both components)

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

Materials/Bibliography/Reading lists:

Prescribed text:

Smith, T.M. and Smith, R.L. 2006. Elements of Ecology 6th Ed. Benjamin Cummings; ISBN-10: 0805348301 ISBN-13: 978-0805348309

Recommended text:

MacKenzie, A; Ball, A and Virdee, S. 2006. BIOS Instant Notes Ecology 2nd Ed. BIOS Scientific Publishers Ltd. Oxford. ISBN 1-85996-257-2

BIOL2404 MOLECULAR & POPULATION GENETICS

(3 Credits) Semester 2 Level II

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

Rationale: The course is intended to provide a comprehensive and balanced account of genetics and genomics by integrating the subfields of classical genetics, molecular genetics and population genetics.

Course Description:

The course will introduce students to the genetics of living (prokaryotic and eukaryotic) organisms and will show how genetics is relevant to all the members of our technological society. Understanding the principles of inheritance will help us to make knowledgeable decisions about personal issues affecting us as well as issues of social concern.

Learning Outcomes:

Upon successful completion of this course students should be able to:

- explain the biological processes including expression, regulation, mutation, transmission, recombination, mapping, cloning of genes and analysis genomes in individuals and populations of living organisms.

- describe the experimental methods used by geneticists to solve biological problems.
- display critical thinking skills that will be useful in the genetic analysis of living organisms.

Content:

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

Teaching Methods/Approaches:

Method/Approach	Contact Hours	Credit Hours
Formal Lectures	18	18
Tutorials	3	3
Field and Laboratory work	36	18
Total	57	39

Assessment procedures/Methods:

(Students are required to pass all components)

One 2-hour theory examination paper 60%

Coursework 40%

- One 2-hour practical test 20%
- Laboratory reports (4 x 5% each) 20%

Materials/Bibliography/reading lists:

Prescribed text:

Klug, W. S., Cummings, M. R. & Spencer, C. A., 2009. Concepts of Genetics. Pearson Benjamin Commings, San Francisco . 779 pp ISBN- 13:978-0-321-52404-1

Highly Recommended texts:

Snustad, D.P.; Simmonds, M.J. 2009. Principles of Genetics. John Wiley and Sons, New Jersey. 823 pp. ISBN 978-0-470-38825-9

On-line resources:

http://www.accessexcellence.org/RC/genetics.php

****BIOL2405 THE BIOLOGY OF MICROORGANISMS (Not available in 2012/13)****

(3 credits) Semester 2 Level II

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

Rationale:

Microbiology, the study of microorganisms, plays a very important role in Biology, being a component of almost every field of Biology. After completing this course, students should be versed in general microbiology and its relationship to other biological sciences, public health, and the environment. Essentially, the course replaces and re-focuses the Level 2 course, BIOL2252 Eukaryotic Microorganisms.

Course Description:

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

Learning Outcomes:

At the end of this course students should be able to:

- Distinguish between the different classes of microorganisms
- Describe the nutrition, growth and metabolism of microorganisms
- Outline the roles of microorganisms in the environment, industrial processes, animal and plant health and disease.

Content:

This course will cover the following topics:

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

Teaching Methods/Approaches:

The teaching of this course will be carried out using the following strategies:

Method/Approach	**Contact Hours**	**Credit Hours**
Formal Lectures	18	18
Laboratory sessions	36	18
Tutorials	3	3
Total	57	39

Assessment Procedures/Methods:

(Students are required to pass all components)

One 2-Hour Final Examination Paper		50%
Course Work		50%
Two 1-Hour Course Tests	20%	
Laboratory Reports (3 x 10% each)	30%	

Materials/Bibliography/Reading lists:

Deacon, J. W. (2006) Fungal Biology. Blackwell Publishing Ltd. ISBN-13:987-1 4051-3066-0; ISBN-10: 1-4051-3066-0.

Madigan, M. T., Martinko, J. M. and Parker, J. (2006) Brock Biology of Microorganisms. Prentice Hall, New Jersey. ISBN0-13-219226-8.

Kelly Cowan, K. and Park Talaro, K. (2008). Microbiology: A Systems Approach. McGraw-Hill. 896 pp. ISBN-13: 978-0077266868.

Vashishta, B. R. (2001) Botany for Degree Students: Algae. S. Chand & Co. Ltd. 456 pp. ISBN: 81-219-0827-2.

Online Resources:

http://www.ncbi.nlm.nih.gov/books/NBK7627/
http://www.virology.net/
http://mycology.cornell.edu/

BIOL2406 EUKARYOTIC MICROBIOLOGY

(3 credits) Semester 1 Level II

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

Rationale:

The eukaryotic microbes form an important link between the prokaryotes and the higher order eukaryotes, illustrating the progressive nature of life forms. Knowledge of the protists and fungi along with their interrelationships to other life forms is crucial to the understanding of the vital roles that these organisms fulfil in the environment. This level II course seeks to promote a critical awareness in the students of the contributions of these microorganisms to the biogeochemical cycles, food and medical industries as well as to environmental pollution and pathogenesis. Students are provided with foundation material for the study of the applied aspects of biotechnology and environmental management at higher levels.

Course description:

The course is designed to expose students to the nature and properties of eukaryotic microorganisms, their effects on humans and the environment, and how they may be exploited to provide useful products.

Learning Outcomes:

Critical thinking and creativity within a scientifically ethical framework are skills promoted through the learning experiences designed particularly within cooperative and integrative laboratory sessions. Students will be required to effectively communicate their experimental findings and evaluate results from simulations during class presentations.

Upon successful completion of this course the students should be able to:

1. describe the range in morphology and structure of eukaryotic microorganisms and be able to distinguish them from prokaryotes.
2. classify eukaryotic microorganisms.
3. discuss the evolutionary relationships between the groups of eukaryotic microorganisms, to other eukaryotes as well as to the prokaryotes.
4. describe growth and metabolism in eukaryotic microbes.
5. outline the importance of eukaryotic microorganisms in the environment.
6. outline the utilisation of eukaryotic microorganisms in biotechnology.
7. identify and explain strategies for the management of eukaryotic microorganisms in the environment.
8. isolate and aseptically culture selected microorganisms.
9. critically evaluate experimental data gleaned from actual experiments.

Course Content:

A study of the structure and function, taxonomy, reproduction, physiology and ecological applications of the protists and fungi inclusive of:

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

Teaching Method:

Method/Approach	**Contact Hours**	**Credit Hours**
Formal Lectures	18	18
Tutorials	6	6
Laboratory sessions	30	15
Total	54	39

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

Assessment Procedures/Method:

The achievement of learning outcomes will be measured through two components. Students are required to be successful in **both** components.

The final theory exam (2 hours)		**50%**
This paper consists of short answer and essay questions.		
Coursework Component worth		**50%**
consisting of:		
One 2-hour practical test	20%	
Laboratory reports	20%	
Project report	10%	

(Both components must be successfully completed)

Course Material:

1. **Prescribed Text**:
   There is no text currently available that covers all the topics at the appropriate level. Students are advised to read widely from books and papers, e.g. in the recommended reading list and the web pages recommended below.

2. **Recommended Reading**:
   i. Madigan, M. T., Martinko, J. M. and Parker, J., 2008. Brock Biology of Microorganisms. Prentice Hall, New Jersey. ISBN-10: 9780132324601. ISBN-13: 978-0132324601
   ii. Lee, R. E., 2008. Phycology. 4th edition. Cambridge University Press. ISBN-10: 9780521682770. ISBN-13: 978-0521682770
   iii. Webster, J. & Weber, R. W. S., 2007. Introduction To Fungi. Cambridge University Press. ISBN-10: 9780521014830. ISBN-13: 978-0521014830.
   iv. Barsanti, L. & Gualtieri, P., 2006. Algae: Anatomy, Biochemistry and Biotechnology. CRC Press. 301 pp. ISBN-10: 0-8493-1497-4; ISBN-13: 978-0-8493-1467-4.
   v. Alexopoulos, C. J., Mims, C. W. and Blackwell. M., 1996. Introductory Mycology. John Wiley and Sons, New York. 868 pp. ISBN 0-471-52229-5.

3. **Online Resources:**
   1. http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/P/Protists.html
   2. http://comenius.susqu.edu/bi/202/Taxa.htm
   3. http://www.algaebase.org/
   4. http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/Endosymbiosis.html
   5. http://www.experiment-resources.com/index.html
   6. http://www.mycolog.com/
   7. http://herbarium.usu.edu/fungi/FunFacts/StudyGuide.htm
   8. http://www.biology.ed.ac.uk/research/groups/jdeacon/statistics/tress2.html#THESCIENTIFICMETHOD

BIOL2407 BIOLOGICAL EVOLUTION

(3 credits) Semester 1 Level II

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

Rationale:

Evolution is the unifying principle of all of biology, and is therefore fundamental to all branches of the biological sciences. By having knowledge and understanding of the principles of evolution, the Biology student will appreciate its application to biological and global issues. When students appreciate principles of evolution they also develop a scientific way of thinking about biological diversity and an even deeper appreciation for the tremendous diversity of life on the planet.

Course Description:

Biological Evolution covers population genetics and provides an overview of evolutionary thought. The course establishes evolution as a demonstrable fact, and presents natural selection as an observable process. This course will also prepare students to analyze biological data in an objective fashion, and to use evolutionary thinking to understand complex biological issues.

Learning Outcomes

At the end of the course, student will be able to:

- Identify the mechanisms of evolutionary change
- Describe the experimental and analytical methods used in evolutionary science
- Explain how population and genetic models can be applied to real life issues
- Apply evolutionary thinking to interpreting patterns in biology

Course Content:

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

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations, with 30 hours of laboratory- and field-based based investigations focused on population genetic and quantitative aspects of evolutionary investigation (e.g., design of experiments, simple statistics, and the presentation of results) and 6 hours of interactive tutorial sessions. (39 contact hours).

Methods of Assessment:

(Students are required to pass both components)

Final theory examination (2 hr.)		50%
Coursework:		50%
Two 1-hour MCQ papers (2 X 20%)	40%	
Laboratory report (1 X 10%)	10%	

References:

Prescribed Text:

Freeman, S., and Jon C. Herron. 2010. Evolutionary Analysis, 5th Edition. Prentice Hall. ISBN-10: 0132275848

Online resources:

http://evolution.berkeley.edu/evolibrary/article/evo_01
http://www.ucmp.berkeley.edu/history/evolution.html
http://www.pbs.org/wgbh/evolution/

BIOL2408 DIVING FOR SCIENTISTS

(3 credits) Semester 3 Level II

Pre-requisites: **Lecturer's approval required**.

Students must have 24 first year credits in the FST, a certificate of "Fitness to Dive" from the University Health Centre and be able to pass a test of swimming competence.

Rationale:

Organisms are best understood by observing them directly in their habitat. For marine organisms, however, their salt water surroundings makes this a challenge to scientists. SCUBA has changed that. Allowing scientists to stay underwater for extended periods has made scuba equipment an invaluable tool for the study of marine (and freshwater) environments.

Since its development in 1943, SCUBA (self-contained underwater breathing apparatus) has enabled researchers to dive longer and deeper and closely study millions of underwater species and their vibrant ecosystems. To mark scuba's important contribution to underwater science, the Smithsonian Institution convened a special symposium at the National Museum of Natural History in May 2010 entitled "Research and Discoveries: The Revolution of Science through SCUBA." The over 40 presentations showed the wide variety of research that has been possible because of SCUBA.

With thorough training, scientific SCUBA is a safe and effective research tool for scientists from interdisciplinary fields to study the underwater environment. This course seeks to provide such training to students.

Course description:

This course provides the student with an introduction to the principles of diving, diving physiology and the effects of hyperbaric pressure on the body, safe diving practices, and an understanding of

diving equipment and how it works. Students acquire the skill of SCUBA diving and have the opportunity to use diving as a tool for scientific research through the design and execution of a research project. The knowledge gained in this course has obvious practical application in the fields of marine and freshwater biology, coastal and fisheries management, and aquaculture.

Learning Outcomes:

Upon successful completion of the course, students should be able to:

1. plan and safely execute a SCUBA dive to a depth of 20 meters (World Underwater Federation, CMAS, 1 star diver standard).
2. interpret data collected underwater using SCUBA following a research plan they have formulated themselves.

Course Content:

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

Methods of delivery:

The course comprises 15 hours of lectures, 6 hours of tutorials (two of which will be dedicated to research project design and assessing the feasibility of projects) and 36 hours of practical work, split between the swimming pool and open water and including at least 6 hours of student directed in-water research done using SCUBA diving.

Methods of assessment:

(Students are required to pass both components)

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

Materials/Bibliography/Reading List:

1. **Prescribed:**
   Graver DK. 2009. Scuba Diving. 4th Ed. Human Kinetics Publishers. **ISBN-13:** 978-0736079006

2. **Highly recommended:**
   Scuba Educators International Air Diving Tables (waterproof)

3. **Recommended:**
   Kaplan EH, Peterson RT, Kaplan SL. 1999. A Field Guide to Coral Reefs: Caribbean and Florida (Peterson Field Guide). **ISBN-13:** 978-0618002115

4. **Useful websites:**
   http://www.divermag.com/
   http://www.alertdiver.com/

BOTN2401 PLANT FORM AND SYSTEMATICS

(3 credits) Semester 1 Level II

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

Rationale:

A comprehensive knowledge of the organisation of the plant body, the systems that coordinate plant life and how these impact on the nomenclature, classification and identification of the embryophytes

is prerequisite to understanding their form and phylogeny. This course is designed to provide a foundation in the diversity of, and the evolutionary relationships between the major groups of plants.

Course Description:

This course introduces students to the organization of tissues, the gross structure of plants and how these mediate the interaction of sporiferous and seed-bearing plants with their environment, evolutionary relationships, classification of the major groups and the rules of nomenclature in botany.

Learning Outcomes:

Upon successful completion of this course the students should be able to:

1. compare the range in morphology and anatomy of sporiferous and seed-bearing plants.
2. utilise taxonomic data to classify plant specimens.
3. discuss the evolutionary relationships between the different groups of plants.
4. infer the evolution of important vegetative and reproductive features that has led to the dominance and success of extinct and extant groups of plants.

Content:

This course will cover the following topics:

1. Plant body organization
2. Plant form and the environment
    a. Structures involved in:
        i. accessing raw materials from the environment
        ii. structural support of the plant body
        iii. anatomical specializations and structural adaptations of plants
        iv. excretory processes
        v. plant reproduction
    b. Plant habit types and their anatomical features
3. The evolution of plants
4. Plant life cycles
5. Plant systematics
    a. Sources of taxonomic data
    b. Contemporary taxonomic systems and nomenclature of plants
    c. Analysis and interpretation of taxonomic data
    d. Herbaria and plant taxonomic research
6. Plant identification
    a. Sporiferous non-vascular Plants:
        i. Anthocerotophyta
        ii. Hepaticophyta
        iii. Bryophyta
    b. Sporiferous vascular plants:
        i. Pteridophyta
        ii. Sphenophyta
    c. Seed-bearing plants:
        i. The seed habit
        ii. Gymnosperms
        iii. Angiosperms

Teaching Methods/Approaches:

Method/Approach	**Contact Hours**	**Credit Hours**
Formal Lectures	18	18
Tutorials	6	6
Practical work	30	15
Total	54	39

Assessment Procedures/Methods:

The achievement of learning outcomes will be measured through two components. Students are required to be successful in **both** components.

One two-hour theory examination paper 50%

Course Work: 50%

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

Materials/Bibliography/Reading Lists:

Prescribed text:

Beck, C. E., 2010. An Introduction to Plant Structure and Development: Plant Anatomy for the Twenty-First Century. 2nd edition. Cambridge University Press. ISBN-10: 0521518059. ISBN-13: 978-0521518055.

Recommended reading:

1. Mauseth, J. D., 2008. Botany: An Introduction to Plant Biology. 4th edition. Jones & Bartlett Learning. ISBN-10: 9780763753450. ISBN-13: 978-0763753450
2. Judd, W. S, , Campbell, C. S., Kellogg, E. A., Stevens, P. F., Donoghue, M. J., 2007. Plant Systematics: A Phylogenetic Approach, 3rd Edition. Sinauer Associates. ISBN-10: 9780878934072, ISBN-13: 978-0878934072

Internet resources:

www.reading.ac.uk/.../research/.../biosci-**plantdiversity**.aspx
http://www.aspt.net/
http://www.sci.sdsu.edu/plants/plantsystematics/
http://www.ucmp.berkeley.edu/plants/plantae.html

BOTN2402 PHYSIOLOGY OF PLANTS

(3 Credits) Semester 2 Level II

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

Rationale:

This course is designed to provide a foundation in the fundamental concepts of plant physiology through an appreciation of the form and function, growth and development of higher plants. It aims to introduce students to experimental plant science using methods that illustrate basic principles of plant physiology.

Course description:

The course deals with plant functions from the level of cells, tissues, organs to the whole plant. It covers carbon fixation, growth and development, soil-plant relations, transport of substances within the plants and the production of secondary metabolites.

Learning outcomes:

Upon successful completion of the course, students should be able to:

- Identify the main processes and controls of plant cell growth and differentiation.
- Describe developmental stages from seedling to senescence or dormancy, and how they are regulated and affected by plant hormones and other biotic and abiotic factors.
- Describe the pathways and processes of water, mineral nutrient and photosynthate transport in plants.
- Explain differences between the main pathways of carbon fixation and assimilation and identify their benefits under various environmental conditions.
- Undertake, interpret and report basic plant physiological experiments in the laboratory and greenhouse.

Content:

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

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

Teaching method/Approaches:

Method/Approach	**Contact Hours**	**Credit Hours**
Formal Lectures	18	18
Laboratory and greenhouse work	36	18

Tutorials	3	3
Total	57	39

Assessment Procedure/Methods:

(Students are required to pass both components)

One 2-hour theory examination 50%

Coursework: 50%

One 2-hour practical test	20%
Practical reports (5 x 4% each)	20%
One 1-hour In-course quiz	10%

Materials/Bibliography/Reading lists:

Prescribed text:

Taiz, L. and Zeiger, E. (2010) Plant Physiology 5th Ed. Sinauer Associates Inc. ISBN-10:0878938664, ISBN-13: 978-087878667, (Online access: http://5e.plantphys.net/)

Recommended texts:

1. Hopkins, W.G. & Huner, N.P.A. 2008. Introduction to Plant Physiology, 4th ed. Wiley ISBN-10: 0470247665. ISBN-13: 978-0470247662. U$113.60
2. Heldt, H-W. 2005. Plant Biochemistry. 3rd Edition. Elsevier, Amsterdam.
3. Mohr, H and et Schopfer, P. 1995. Plant physiology. Springer Verlag. Berlin.
4. Nobel, P. S. 2009. Physicochemical and Environmental Plant Physiology. 4th Edition. Academic Press-Elsevier, Amsterdam.

ZOOL2401 ANIMAL FORM (Not available from 2013/14)

(3 credits) Semester 2 Level II

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

Rationale:

Knowledge of the structure of animals and animal systems is essential in understanding how animals function. An understanding of animal structure affects the comprehension of most other major fields of zoology, including ecology, physiology and evolutionary biology. This course is designed as a core course for zoological sciences and will be essential for persons wishing to major in Zoology.

Course Description:

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

Learning Outcomes:

At the end of this course students should be able to:

1. identify the relationship between structure of important components and their normal functioning in animals.
2. evaluate and compare selected systems commonly found in animals
3. evaluate and compare cell types commonly found in the selected systems studied.
4. describe the evolution of selected systems through the range of animal phyla.

Course Content:

This course will cover the following topics:

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

Teaching Methods/Approaches:

Method/Approach	Contact Hours	Credit Hours
Formal Lectures	18	18
Tutorials	6	6
Practical work	30	15
Total	54	39

Assessment Procedures/Methods:

(Students are required to pass both components)

One 2-hour theory examination 50%

Course Work: 50%

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

Materials/Bibliography/Reading List:

Prescribed Text:

Starr, C. 2009. Animal Structure and Function (Biology: The Unity and Diversity of Life). Thomson Brooks/Cole, ISBN: 9780534397487

Recommended Texts:

Kardon, K. V. 2007. Vertebrates (Comparative anatomy, Function, evolution). 4th Ed. McGrawHill. ISBN 978-0-07-252830-5.

Lemis, K.V.; Bemis, W.E.; Walker, W.F. and Grande, L. 2009. Functional Anatomy of vertebrates, an evolutionary perspective. Thomson learning ISBN 07-290956-0

Brusca, R. C. and Brusca, G.J. 2006. Invertebrates. 2nd Ed. Sinaure. ISBN 0-87893-097-3

ZOOL2402 ANIMAL PHYSIOLOGY (revised for 2014/15)

(3 credits) Semester 2 Level II

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

Rationale:

Knowledge of how various animal systems function is essential in understanding most other major fields of zoology, including ecology, physiology, evolutionary biology. This course is designed as a core course for zoological sciences and will be essential for persons wishing to obtain a major in Zoology.

Course Description:

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

Learning Outcomes:

At the end of this course students should be able to:

1. evaluate standard physiological concepts such as Bohr shift, countercurrent systems, active transport and negative feedback control.
2. describe the structure of important components involved in the normal functioning of animals.
3. explain the functioning of several major physiological systems found in animals.
4. conduct, analyse and report on the results of simple physiological laboratory experiments conducted on animals.

Course Content:

This course will cover the following topics:

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

Teaching Methods/Approaches:

Method/Approach	Contact Hours	Credit Hours
Formal Lectures	18	18

Tutorials	6	6
Practical work	30	15
Total	54	39

Assessment Procedures/Methods:

(Students are required to pass both components)

One 2-hour theory examination 50%

Course Work: 50%

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

Materials/Bibliography/Reading List:

Prescribed Text:

French, K.; Randall, D. and Burgren, W.E. 2009. Animal Physiology. W.H. Freeman. ISBN- 07-16738635

Recommended Texts:

Starr, C. 2007 Animal Structure and Function (Biology: The Unity and Diversity of Life). Thomson Brooks/Cole, ISBN: 9780534397487.

Schmidt-Nielsen, K. 2008. Animal Physiology: Adaptation and Environment. 5th Ed. Cambridge University Press, ISBN: 9780521570985

ZOOL2403 MAINTENANCE SYSTEMS IN ANIMALS (NEW)

(3 credits) Semester 2 Level II

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

Rationale

Knowledge of the structure of animals and animal systems is essential in understanding how animals function. An understanding of animal structure affects the comprehension of most other major fields of zoology, including ecology, physiology and evolutionary biology. It is therefore critical that students be equipped with a solid exposure to the maintenance systems of animals.

Course Description

This course serves as an introduction to the gross structure and cellular organization of invertebrate and vertebrate animals, with emphasis on systems involved in feeding, gaseous exchange, transport, excretion and reproduction. The relationship between structure and function will be emphasized.

Learning Outcomes

On successful completion of this course, students should be able to:

1. Discuss the relationship between the structure and function of animal systems.
2. Evaluate systems commonly found in animals.
3. Apply microscopy techniques to distinguish various cell types commonly found in the animal systems.
4. Dissect an animal and distinguish the components of its organ systems.
4. Discuss the evolution of animal systems through the range of animal phyla.

Course Content

1. Feeding and digestion
- Structures a used for mastication, digestion, absorption and storage of food
- Gut systems: types of gut systems, overview gut systems of vertebrates and invertebrates.

2. Gaseous exchange
- Important physical considerations: oxygen availability in different environments, diffusion of gases in air and water, impact of shape and size.
- Breathing in water and air, adaptations for diving.

3. Circulatory systems
- Comparison of gastrovascular and blood vascular systems; open and closed systems
- Components of circulatory systems of selected invertebrates and vertebrates
- Evolution of vertebrate circulatory system, microcirculation in vertebrates

4. Excretion and osmoregulation.

- Chemicals involved in excretion and osmoregulation.
- Contractive vacuoles, nephredia, malpighian tubules and nephrons
- Secondary structures: salt glands, rectal glands, urate cells.

5. Reproduction
- Comparison of asexual and sexual reproduction. Alternation of generations.
- Sexual and asexual reproduction various animal groups
- Colonial life: case studies from Prolifera and Cnidaria

Methods of Delivery

This course will be delivered using a mix of interactive lectures, guided problem-solving tutorials, and laboratory classes which will include manipulation of animal material, extensive microscopic examination of whole animals and tissues, and discussions relating structure to function. All relevant course material will be posted on the course website – currently OurVLE at http://ourvle.mona.uwi.edu/.

	Contact Hours	Credit Hours
Lectures	18	18
Tutorials	6	6
Laboratory Classes	30	15
Total	54	39

Assessment:

The course assessment will be as follows:

- One 2-hour final written examination 50%
- Coursework: 50%

Coursework comprised of:

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

Students are required to pass both the theory paper and the coursework

Materials/Bibliography/Reading List

Prescribed Text

1. Brusca R.C. and Brusca G.J. (2006). Invertebrates. 2nd Ed. Sinauer. ISBN 0-87893-097-3.

2a. Kardong K.V. (2007). Vertebrates (Comparative anatomy, function, evolution). 4th Ed. McGraw-Hill. ISBN 978-0-07-252830-5.

OR

2b Liem K.V., Bemis W.E., Walker W.F. and Grande L. (2009). Functional anatomy of vertebrates, an evolutionary perspective. Thomson Learning. ISBN 07-290956-0.

Highly Recommended Text

Pough F., Janis C. and Heiser J. (2008). Vertebrate Life. 8th Ed. Pearson. ISBN13: 9780321600790 ISBN10: 0321600797

Barnes R.S.K., Calow P.P., Olive P.J.W., Golding D.W. and Spicer J.I. (2001) The Invertebrates: A Synthesis. 3rd Ed. Wiley–Blackwell ISBN-10: 0632047615 ISBN-13: 978-0632047611

Recommended Text

Kardong K.V. and Zalisko E.J . (2011). Comparative Vertebrate Anatomy. A Laboratory Dissection Guide. 6th Ed. McGraw-Hill. ISBN (Spiral Bound) 0073369438 ISBN (Paperback): 978-0073369433

Online Resources:

http://highered.mcgraw-hill.com/sites/0072528303/

ZOOL2404 **Coordination and Control in Animals NEW**
3 credits Semester 2 Level 2

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

Rationale:
All processes in animal biology are coordinated and controlled. This ensures that homeostatic mechanisms operate optimally to regulate the internal environment of the animal. An understanding of derivation and modification of morphological structures responsible for coordination and control in different animal groups is essential for appreciating the principles of their evolution and full comprehension of their function.

Course Description
This course will expose students to the derivation and modification of anatomical structures that coordinate and control homeostatic and other metabolic processes in vertebrates and invertebrates. Embryonic development/ontogeny of structures, their basic functional anatomy and evolutionary development/phylogeny will be studied

Learning Outcomes
On successful completion of this course, students should be able to:
1. Apply theoretical principles on animal structure to practical dissection exercises
2. Dissect and identify different types of animal structures involved in coordination andcontrol
3. Recognize and differentiate the main animal cell types in a tissue
4. Evaluate animal structures in relation to their function
5. Discuss evolution and adaptation in animal systems

Course Content
1. Embryonic development and structure of the vertebrate and invertebrate nervous system.
   - Neurulation in the vertebrate.
   - Regional specialization in the vertebrate brain.
   - Meninges and tracts.
   - Evolutionary trends in vertebrate brain development.
2. Reflex action and autonomic function.
   - Structural basis of visceral and somatic reflexes.
   - Comparative anatomy of the autonomic nervous system in vertebrates.
3. Development and evolution of the eye in animals considering mollusc and vertebrate eyes and the compound eyes of Arthropoda.
4. The acoustic-lateralis system.
   - Structure and functioning of hair cells in the teleost lateral line system and in the inner ear.
   - Evolutionary development of the mammalian middle ear bones.
5. The structure of selected endocrine glands and their function.
   - Origins and embryonic development of the vertebrate hypophysis and adrenal gland.
   - A survey of the endocrine system of insects, crustaceans and cephalopods.
6. Muscle development and function.
   - Embryological origins of the different muscle types their location and functions.
   - Detail of the sliding filament theory of muscle contraction.
   - The derivation of jaw muscles and facial muscles from the branchiometric musclature
7. The integument.
   - Formation of the integument in insects and vertebrates.
   - Epidermal and dermal derivatives and their functions.

Methods of Delivery
This course will be delivered using a mix of interactive lectures, guided problem-solving tutorials, and laboratory classes which will include manipulation of animal material, extensive microscopic examination of whole animals and tissues, and discussions on the evolution of various systems. All relevant course material will be posted on the course website – currently OurVLE at http://ourvle.mona.uwi.edu/.

Contact and credits hours are as follows:

	Contact Hours	Credit Hours
Lectures	18	18
Tutorials	6	6
Laboratory Classes	30	15
Total	54	39

Assessment:
The course assessment will be as follows:

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

Students are required to pass both the theory paper and coursework

References

Prescribed

1. Brusca R.C. and Brusca G.J. (2006). Invertebrates. 2nd Ed. Sinauer. ISBN 0-87893-097-3.
2a. Kardong K.V. (2007). Vertebrates (Comparative anatomy, function, evolution). 4th Ed. McGraw-Hill. ISBN 978-0-07-252830-5.

OR

2b Liem K.V., Bemis W.E., Walker W.F. and Grande L. (2009). Functional anatomy of vertebrates, an evolutionary perspective. Thomson Learning. ISBN 07-290956-0.

Highly Recommended

Pough F., Janis C. and Heiser J. (2008). Vertebrate Life. 8th Ed. Pearson. ISBN13: 9780321600790 ISBN10: 0321600797

Barnes R.S.K., Calow P.P., Olive P.J.W., Golding D.W. and Spicer J.I. (2001) The Invertebrates: A Synthesis. 3rd Ed. Wiley–Blackwell ISBN-10: 0632047615 ISBN-13: 978-0632047611

Recommended

Kardong K.V. and Zalisko E.J . (2011). Comparative Vertebrate Anatomy. A Laboratory Dissection Guide. 6th Ed. McGraw-Hill. ISBN (Spiral Bound) 0073369438 ISBN (Paperback): 978-0073369433

Online Resources:
http://highered.mcgraw-hill.com/sites/0072528303/

LEVEL 3 COURSES
(Three 4-credit courses unchanged for 2012/13)

BIOL3018 (BL39C) **PROJECT (No longer available – replaced with BIOL3411 / BIOL3413)**
(4 credits) Semester 1 or 2 Level III

Aim: To equip students with the basic knowledge and skills required to undertake and report on scientific research in the field of biology.

Objectives: On completion of the course students should be able to:
- Search information bases for appropriate supporting literature for a given topic.
- Formulate hypotheses for a proposed piece of scientific research and design appropriate means for testing the same.
- Collate and analyse data from their research and prepare a report in standard scientific format.

Pre-requisite: BIOL2402 - Fundamentals of Biometry or BIOL2015 (BL20P) - Biometry

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

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

Mode of Delivery:

8 hours of lectures, 2 hours of interactive tutorial sessions and 56 hours of student-driven research under the supervision of a member of the academic staff.

Method of Assessment:

Project report	75%
Oral Examination	25%

AGBU3008 AGRICULTURE INTERNSHIP

(4 credits) Summer Level III

Pre-requisite: Lecturer's approval required.

Description: Please see outline in Faculty handbook for BIOL3412.

AGBU3012 (AM312) RESEARCH PROJECT

(4 credits) Semester 1 & 2 Level III

Aim: To equip students with the basic knowledge and skills required to undertake and report on scientific research in the field of biology.

Objectives: On completion of the course students should be able to:

- Search information bases for appropriate supporting literature for a given topic.
- Formulate hypotheses for a proposed piece of scientific research and design appropriate means for testing the same.
- Collate and analyse data from their research and prepare a report in standard scientific format.

Pre-requisite: none

Course Content:

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

Mode of Delivery:

8 hours of lectures, 2 hours of interactive tutorial sessions and 56 hours of student-driven research under the supervision of a member of the academic staff.

Method of Assessment:

Project Report	80%
Oral Presentation	20%

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

NEW LEVEL 3 COURSES
(Revised and presented as 3-credit courses as of 2012/13 Academic Year)

AGCP3405 LANDSCAPE AND TURFGRASS PRODUCTION

(3 credits) Semester 1 Level III

Pre-requisite: BOTN2402 Physiology of Plants

Rationale:

The process of landscape and turfgrass production is important for the creation of beautiful environments for homes and businesses, verges for highways and roads, fields for sporting facilities and 'greening' of the built environment to help mitigate climate change. With the increase of urban

sprawl these career opportunities are increasing daily. Plant science and landscaping skills taught in this course will prepare students to meet the demands of this growing industry.

Course Description:

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

Learning Outcomes:

On completion of the course students should be able to:

1. identify a wide range of woody and herbaceous landscape plants,
2. schedule and perform basic landscape and turf maintenance tasks such as mowing, edging lawns; irrigation system adjustment and monitoring; selection and application of fertilizers; pruning of small trees, shrubs and vines; selection and application of pest control materials; and operating various types of landscape and turf maintenance equipment and tools;
3. discuss the importance and application of licensing laws and regulations pertaining to landscape contracting and maintenance,
4. design and apply landscape and turfgrass maintenance and management practices,
5. outline the major environmental issues (water conservation, water quality, salmon recovery, pesticide hazards, etc.) that affect the landscape and turfgrass industry,
6. devise, estimate and formulate the installation process for landscape projects.

Course Content:

1. Introduction to Landscape and Turfgrass production
2. Landscape and Turfgrass Identification and uses
3. Turfgrass ecology and biology
4. Landscape and turf establishment and renovation
5. Turf pest management (weeds, insects, diseases)
6. Evaluating Opportunities in the Landscaping and Turfgrass Industries
7. Licensing laws and regulations pertaining to landscape contracting and maintenance
8. Environmental issues: water usage and pollution issues

Methods of Delivery:

Course delivery includes the reading and attendant evaluation in tutorials of research papers by the students, interactive tutorial sessions (6 contact/credit hrs.), collaborative laboratory and field work as well as site visits (30contact/15 credit hrs.). Instructional support for these activities will be complemented through 18 contact/credit hours of lectures.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour theory paper	50%
Course work	50%
Consisting of one 2-hour practical (field) test	20%
Field exercise and field trip report	15%
Research and oral presentation	15%

References:

1. **Prescribed**

   Ingels, J.E. 2009. Landscaping Principles and Practices. Cengage Learning Press. ISBN-10: 1428376410, ISBN-13: 978-1428376410

   Pessarakli, M. 2008. Handbook of Turfgrass Management and Physiology. CRC Press. ISBN: 978-0-8493-7069-4.

2. **Highly Recommended**

   Carrow, R.N., Duncan, R.R. and Huck M.T. 2008. Turfgrass and Landscape Irrigation Water Quality: Assessment and Management. CRC Press, FL. ISBN-10: 1420081934, ISBN-13: 978-1420081930.

3. **Recommended**

   Turgeon, A. J. 2012. Turfgrass management. Prentice Hall, Upper Saddle River, MJ, ISBSN-13: 978-0-13-707435-8, ISBN-10: 0-13-707435-2

4. **Useful Websites**

   www.cpe.rutgers.edu/programs/**landscape**.html

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

Pre-Requisites: BOTN2401 Plant Form and Systematics; BOTN2402 Physiology of Plants

Rationale:

A wide variety of fruits is grown in tropical countries like Jamaica. Tropical developing countries need to ensure that the quality of their agricultural products will satisfy the highest expectations of the food industry and consumers. In addition, farming practices should ensure that fruit crops are produced under sustainable economic, social and environmental conditions. There is therefore need to provide the principles and practices for sustainable fruit crop production for the mainstream horticulturist.

Course Description:

This course presents the specific principles associated with tropical fruit crop farming, the optimum growth and sustainable yield. It starts with the value of fruit crops, the production principles and the innovations and how they can be adapted to local prevailing conditions of a tropical country including ecological variables, farming systems and cultural practices.
The course is essential for use in the fields of horticulture, agronomy and food science. It will tool graduates to meet the demands of the agriculture industry for new types of crops and sustainable production methods.

Learning Outcomes:

Upon completion of this course, students should be able to:

1. classify tropical fruit crops and indicate their agronomic importance,
2. explain the steps to achieving high yield in a range of fruit crops,
3. demonstrate skills and knowledge in the field of "Best Agricultural Practices" of fruit crops production under tropical conditions,
4. identify and discuss fruit crops which have socio-economic potential for future development of the tropical region,
5. evaluate the research needs of the Jamaican fruit crop industry**.**
6. determine the role of fruits in human nutrition

Course Content:

1. Classification of tropical fruit crops
2. Introduction to the status of fruit crop industry with specific reference to tropical/sub-tropical crops.
3. The role of fruits in human nutrition
4. The scientific principles of fruit crop growth and yield development.
5. Production principles and technologies used in commercial fruit crop enterprises
6. Assessment of the commercial potential of minor fruits
7. Current issues and research needs of tropical fruit crops in Jamaica

Methods of Delivery:

Course delivery includes the reading and attendant evaluation of research papers in tutorials by the students, interactive tutorial sessions (6 contact/credit hrs.), collaborative laboratory and field work as well as site visits (30 contact/15 credit hrs.). Instructional support for these activities will be complemented through 18 contact/credit hours of lectures.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour theory examination		50%
Course work		50%
Consisting of		
one 2-hour practical test	20%	
Laboratory (10%)and field trip (5%) report	15%	
Research (10%) and oral (5%) presentation	15%	

References:

1. **Prescribed**

Nakasone, H.Y. and Paull, R.E. 2008. Tropical Fruits (Crop Production Science in Horticulture). Publisher: CABI; First edition ISBN-10: 0851992544, ISBN-13: 978-0851992549

2. **Recommended**

Klein, C. 2009. Grow Your Own Fruit (Rhs) Publisher: Mitchell Beazley; 1st edition. ISBN-10: 1845334345, ISBN-13: 978-1845334345.

AGCP3407 POSTHARVEST TECHNOLOGIES

(3 Credits) Semester 2 Level III

Pre-Requisites: BOTN2402 Physiology of Plants

Rationale:

With increasing concern about local food security, the losses associated with poor handling of agricultural produce and the resultant poor quality of fresh produce are matters of great concern to food processors and consumers alike. Because postharvest handling is the most important stage, this course will develop in students basic knowledge and understanding on how to reduce post-harvest losses of fresh crops fruits and vegetables, and also how to maintain and extend their shelf-life.

Course Description:

This course will provide students with the basic knowledge and understanding of the ripening of crops and their senescence, as well as the different physiological and biochemical processes affecting the quality attributes of fresh crops. Details on the strategies and techniques to be utilised in the proper handling of fresh crops will also be explored. This will include the application of appropriate technologies to extend the shelf-life of crops, ensuring that they are maintained as "fresh as fresh". Integrated and combined postharvest preservation technologies will also be considered and discussed.

Learning Outcomes:

Upon completion of this course, students should be able to:

1. classify horticultural crops and indicate their importance,
2. practise harvesting handling **for** transportation of fresh crops,
3. explain the concepts of maturation, ripening and senescence of crops,
4. analyse the physiology of respiratory parameters of fresh crops,
5. apply storage technologies to control deterioration and decay of fresh crop and how to extend the shelf-life,
6. demonstrate skills in the field of postharvest technologies under tropical conditions,
7. design and develop appropriate "*Best Postharvest Practices*" in the tropics**.**

Course Content:

1. Ripening and Senescence of Fruits
   Maturation, Ripening, Senescence
2. Determinants of Readiness for Harvest
   Maturation index, Ripening index
3. Harvesting Practices
   Manual harvesting, Mechanical harvesting
   Best Agricultural Practices and harvesting
4. Preparation for Storage and Transport
   Transportation, Handling, Packaging
5. Storage Technologies
   Refrigeration, MA/CA packaging, Irradiation, Chemicals
   Other physical technologies (IR, UVc, hot water, etc.)
6. Post-harvest Changes and Loss of Value

Methods of Delivery:

Course delivery includes the reading and attendant evaluation of research papers by the students, interactive tutorial sessions (6 contact/credit hrs.), collaborative laboratory and field work as well as site visits (30contact/15 credit hrs.). Instructional support for these activities will be complemented through 18 contact/credit hours of lectures.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour theory paper		50%
Course work		50%
Consisting of one 2-hour practical test	20%	
Laboratory and field trip report	15%	

Research and oral presentation 15%

References:

1. **Prescribed**
   i. Weichman, J. 1987 Postharvest physiology of vegetables. Marcel Dekker, New York**.** ISBN: 0-8247-0749-4.
   ii. Benkeblia, N. 2006 Postharvest Technologies for Horticultural Crops, Volume 1. Research Signpost Publisher, Kerala. ISBN: 81-308-0110-8
   iii. Benkeblia, N. 2009 Postharvest Technologies for Horticultural Crops. Volume 2. Research Signpost Publisher, Kerala. ISBN: 978-81-308-0356-2
2. **Highly Recommended**
   Thompson, A.K. 1996 Postharvest Technologies of Fruits and Vegetables. Blackwell Science, London. ISBN-10: 0632040378 , ISBN-13: 978-0632040377.
3. **Recommended**
   Rubatzky, V. E. and Yamaguch, M. 1997 World vegetables: principles, production and nutritive values. Chapman & Hall, New York. ISBN: 0-412-11221-3.
4. **Useful Websites**
   http://postharvest.ucdavis.edu/Pubs/pub_list.shtml
   http://www.fao.org/world/Regional/RNE/inform/faoand/page60/page60_en.htm
   http://www.davisfreshtech.com

BIOL3400 ISSUES IN CONSERVATION BIOLOGY
(3 Credits) Semester 2 Level III

Pre-requisites: BIOL2403 Principles of Ecology and BIOL2408 Biological Evolution

Rationale:

The Earth is now undergoing an unprecedented, human-induced extinction crisis, and global climate change is not only exacerbating existing threats to biodiversity, but is also threatening the future existence of humans as well. Conservation Biology is the academic discipline concerned with averting extinctions and maintaining the integrity of Earth's ecosystems.

Description:

Issues in Conservation Biology provides an overview of the field of Conservation Biology, while focusing on examples from Jamaica and the wider Caribbean. The course covers the recent, anthropogenic assault on Earth's species and habitats, and highlights the main drivers of the recent extinction crisis; it also details efforts to arrest the current biodiversity extinction crisis, including both *in situ* and *ex situ* interventions.

Learning Outcomes:

At the end of the course, student should be able to:

- Describe the history and current status of the human-mediated extinction crisis
- Explain how population genetic models can be used to inform conservation efforts directed at endangered species
- Outline the values of and threats to biodiversity
- Argue why island species are particularly vulnerable to anthropogenic impacts such as invasive species
- Compare techniques used to control or eradicate invasive species
- Evaluate the theoretical and practical aspects of designing protected areas

Course Content:

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

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations, with 30 hours of field-based based demonstrations and practical exercises focused on relevant (local) examples of

conservation biology and 6 hours of tutorials/discussion sessions exploring the application of theoretical knowledge to solving problems related to effective conservation of species and habitats.

Assessment:

(Students are required to pass both components):

One 2-hour theory paper	50%
Coursework:	50%
Two 1-hour MCQ/short answer papers (2 X 20%)	40%
Field exercise report (1 X 10%)	10%

Reference Material:

Prescribed Text:

Primack, R. B. 2010. Essentials of conservation biology, 5rth Edition. Sinauer Associates, Inc. ISBN-10: 0878936408.

Online resources:

http://www.mongabay.com/conservation-biology-for-all.html
http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1523-1739
http://www.iucnredlist.org/

****BIOL3401 ENVIRONMENTAL MICROBIOLOGY (Not available in 2013/14)****

(3 Credits) Semester Level 3

Pre-Requisites: BIOL2406- Eukaryotic Microbiology

Rationale:

Environmental Microbiology, the study of microorganisms that inhabit the Earth and their roles in carrying out processes in both natural and human-made systems, is one of the core concepts in microbiology. The subject emphasizes the interface between environmental sciences and microbial ecology.

Since the late 1980s, there has been increased interest in environmental microbiology resulting from the application of novel molecular techniques. New technologies are constantly introduced that address problems such as detoxification of hazardous chemicals, environmental biomonitoring and bioremediation of air, water, and soil.

An environmental microbiologist thus needs a good grounding in basic microbiology and molecular biology, combined with knowledge of environmental science.

Course Description:

This course will entail detailed study of various microorganisms in different natural and man-made environments. The course is designed to explore microbial abundance, distribution, and activities with regards to nutrient cycling, organic compound decomposition, bioremediation, and waste management in the environment.

This course will provide students with the theoretical knowledge, practical skills and an appreciation of the application of the subject. It further aims to equip students with skills to enable them to pursue a career in applied and basic research in areas related to agriculture, environment and medicine.

Learning Outcomes:

At the end of the course, students will be able to:

- differentiate between various microbial groups, activities and physiological aspects of microorganisms;
- demonstrate various ways through which microorganisms adapt to and transform their environments;
- appraise the importance of microorganisms in biodeterioration, solid and liquid waste (sewage) treatment, bioremediation, biodegradation, biological pest control and public health.
- apply the proper laboratory techniques and use of equipment essential to the collection, isolation and identification of microorganisms.

Course Content:

- Cell Biology and Genetics: Overview of the chemical composition of microbial cells, cell structure, genetic elements, mutation and genetic exchange, taxonomy and phylogeny.

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

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations within environmental microbiology and15 hours of laboratory investigations based on the core material. Six tutorial sessions will adopt a problem-based learning (PBL) approach to applied aspects of environmental microbiology. (39 contact hours).

Course Assessment:

(Students are required to pass both components):

Final Theory Examination (2hours)		50%
Coursework:		50%
Laboratory Reports (3 x 5%) & Student presentations (15%)	30%	
Participation in tutorials (submission of PBL responses)	5%	
In-Course Test (1h)	15%	

References:

1. **Prescribed**
   Gentry T, Maier R, Pepper I (2008) Environmental Microbiology 2nd edition. Academic Press. ISBN 978-0123705198
2. **Highly recommended**
   Weeks B (2010) Alcamo's Microbes and Society.3rdJones & Bartlett Learning. ISBN 978-0763790646
3. **Recommended**
   Madigan M, Martinko J, Dunlap P, and Clark D. (2008) Brock Biology of Microorganisms 12th edition. Benjamins Cummings. ISBN 978-0132324601.
   Atlas R and Bartha R (1997) Microbial Ecology: Fundamentals and applications.4th edition. Benjamins Cummings. ISBN 978-080530655.
   Emp P, Cole J, Sherr E (1993) Handbook of Methods in Aquatic Microbial Ecology. CRC-Press. ISBN 978-0873715645
4. **Useful websites**
   http://www.blackwellpublishing.com/madsen/

****BIOL3402 BIOLOGY OF THE FUNGI (Not available in 2014/15)****

(3 credits) Semester Level III

Pre-requisites: BIOL2406- Eukaryotic Microbiology

Rationale:

The fungi are a vitally important component of various ecosystems, though often unnoticed. Distinguished by their modes of vegetative growth and nutrient intake, fungi result in invaluable ecological functions in mineralization and recycling, influencing the nutrition, development, health and welfare of all other organisms. Through their largely hidden activity and growth, these ubiquitous eukaryotes predicate significant effects on the economy and commerce between nations.

Course Description:

The course is designed to expose students to the tremendous diversity and ecological importance of the fungi in roles of decomposers, parasites and their symbiotic relationships. Students will develop

an informed and knowledgeable perspective of the medicinal benefits, poisonous risks, premium value as highly prized delicacies and the importance of the fungi to the daily existence of other life forms and industrial applications. This will be accomplished through the study of their varied morphology, structure, physiology, modes of reproduction, taxonomy and evolutionary relationships. Laboratory and field exercise will provide the learning opportunities for identification, culture and the observation of the diversity and metabolism of the fungi.

Learning Outcomes:

Critical thinking, competence and creativity are transferrable skills imparted within a scientifically ethical framework through collaborative laboratory sessions, field work and consultative learning experiences. Students will be required to carry out laboratory investigations then effectively communicate experimental findings and evaluate results from simulations during learning activities.

Upon successful completion of this course the students should be able to:

1. differentiate the biological characteristics of the major groups of fungi.
2. construct a taxonomic key that reflects the diversity and classification of fungi.
3. assess the importance of the relationships of fungi to each other and other organisms.
4. conduct studies to investigate the behaviour of fungi under various environmental conditions.
5. construct life cycles and reproductive strategies employed by the fungi.
6. illustrate suitable methods for obtaining, culturing and preserving various types of fungi.
7. appraise the diverse ecological roles fulfilled by the fungi, the current and developing uses of fungi to Man.

Course Content:

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

Methods of Delivery:

Course delivery includes the reading and attendant evaluation of research papers by the students, interactive tutorial sessions (6 credit hrs.), case studies, audiovisual documentary material, collaborative laboratory and field work as well as site visits (15 credit hrs.). Instructional support for these activities will be complemented through 18 credit hours of lecture-discussion approaches.

Methods of Assessment:

(Students are required to pass both components):

Final Theory Examination (2 hours)		50%
Coursework		50%
Comprised of:		
o Laboratory reports (5 x 4%)	20%	
o Oral presentation of a tutorial topic	10%	
o One 2 hour in-course test (theory and practical)	20%	

References:

1. **Prescribed**:

   Webster, J. and Weber, R., 2007. Introduction To Fungi (3rd edition). Cambridge Univ. Press. ISBN-10: 0521014832. ISBN-13: 978-0521014830

2. **Highly Recommended**:

   Deacon, J. 2005. Fungal Biology Blackwell Publishing Ltd. ISBN-13: 987-1-4051-3066-0. ISBN-10: 1-4051-3066-0

3. **Recommended**:
    a. Moore-Landecker, E., 1996. Fundamentals of the Fungi. Prentice Hall ISBN: 0-13-376864-3
    b. Alexopoulos, C., Mims, C. & Blackwell, M. 1996. Introductory Mycology. John Wiley. ISBN: 0-471-52229-5
4. **Useful Websites**:
    http://www.fungionline.org.uk/1intro/5importance.html
    http://tolweb.org/Fungi
    http://comenius.susqu.edu/bi/202/Fungi/default.htm

BIOL3403 THE BIOLOGY OF SOIL
(3 Credits) Semester 1 Level III

Pre-Requisites: BIOL2403 Principles of Ecology

Rationale:

Knowledge of soil as a habitat for diverse forms of life is necessary in biological studies of the terrestrial environment. The soil is a critical component of ecological nutrient cycles and agro-ecosystems, so it is important to examine and interpret how agricultural management practices and environmental factors affect soil biodiversity and biological processes.

Course Description:

The course is intended to provide an introduction to the physico-chemical features of typical soils, the various groups of organisms inhabiting soil and their role in soil biological processes. Also, the effects of agronomic practices and environmental factors like acidification and pollution on soil organisms and processes will be appraised.

Learning Outcomes:

Upon successful completion of the course, students should be able to:

- describe the main abiotic and biotic components of the soil environment;
- explain the important biological processes in the soil;
- analyze the effects of agronomic management practices and changing environmental factors on soil biota and biological processes;
- apply laboratory and field techniques to study the effects of various environmental factors on the activities of soil organisms.

Course Content:

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

Methods of Delivery:

Course delivery includes the reading and attendant evaluation of research papers by the students, interactive tutorial sessions (6 contact/credit hrs.), collaborative laboratory and field work as well as site visits (30contact/15 credit hrs.). Instructional support for these activities will be complemented through 18 contact/credit hours of lectures.

Methods of Assessment:

(Students are required to pass both components):

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

References:

Highly Recommended

Bardgett, R. D. 2005. The Biology of Soil: A Community and Ecosystem Approach. Oxford University Press. ISBN-10: 0198525036, ISBN-13: 978-0198525035.

Recommended

1. Brady, N.C. and R.R. Weil. 2007. The nature and properties of soils, 14th ed. Pearson-Prentice Hall. ISBN-10: 013227938X, ISBN-13: 978-0132279383.
2. Coleman, D.C., D.A. Crossley Jr. and P.F. Hendrix. 2004. Fundamentals of Soil Ecology, 2nd ed. Academic Press. ISBN-10: 0121797260, ISBN-13: 978-0121797263.
3. Kohnke, H. and D.P. Franzmeier. 1994. Soil Science Simplified. 4th sub-ed. Waveland Press Inc. ISBN-10: 0881338133, ISBN-13: 978-0881338133.
4. Paul, E.A. (ed.) 2007. Soil Microbiology, Ecology and Biochemistry, 3rd ed. Academic Press. ISBN-10: 0125468075, ISBN-13: 978-0125468077.

Useful Websites

http://wps.prenhall.com/chet_brady_natureandp_14/
http://www.soilhealth.see.uwa.edu.au/index
http://soils.usda.gov/sqi/concepts/soil_biology/biology.html
http://www.ciat.cgiar.org/ourprograms/TropicalSoil/Pages/TropicalSoil.aspx
http://www.intute.ac.uk/agriculture/cabi_s.html

BIOL3404 VIROLOGY

(3 Credits) Semester Level III

Pre-Requisites: BIOL2404 Molecular and Population Genetics or BIOL2312 Molecular Biology 1

Rationale:

Virology is the branch of science which focuses on the study of viruses, complexes of nucleic acids, and proteins that have the capacity for replication. The historic reason for the discovery and characterization of viruses, and a continuing major reason for their study, involves the desire to understand and manage diseases caused by these agents. Additionally, the study of viruses provides the basis for much of the fundamental understanding of cellular gene expression, mechanisms for generating genetic diversity and processes involved in the control of cell growth and development.

Course Description:

This course will provide core training in the theoretical and practical aspects of virology, covering viruses (and virus-like agents) infecting human, animal, plant and microbial hosts. The course includes studies of the structure, the molecular biology of virus replication, interactions of viruses and hosts and the diseases they cause in these hosts, the evolution and history of viruses and virus diseases, transmission, diagnosis, and the prevention of virus disease by vaccination, drugs and other methods. Knowledge gained in this course has obvious practical application in the management of virus infections and will impact the understanding of cell biology, molecular biology, genetics, and immunology. It further aims to equip students with skills to enable them to pursue a career in research, control or teaching related to medical or plant virology.

Learning Outcomes:

At the end of the course, students will be able to:

- identify the major groups of viruses of human, animal, plant and microbial hosts;
- compare replication cycles and transmission mechanisms of viruses;
- differentiate types of relationships viruses establish with their human, animal, plant and microbial hosts;
- propose diagnostic, preventive and treatment strategies for the management of virus infections.

Course Content:

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

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations, with 30 contact/15 credit hours of laboratory investigations based on the core material. Six tutorial sessions will adopt a problem-based learning (PBL) approach to applied aspects of virology.

Methods of Assessment:

(Students are required to pass both components)

Final Theory Examination (2h)		60%
Coursework:		40%
Laboratory Report	15%	
Participation in tutorials (submission of PBL responses)	5%	
In-Course Test (1hr)	20%	

References:

Prescribed

Carter, J. and Saunders, V. 2007.Virology: Principles and Applications. John Wiley and Sons Ltd. ISBN 978-470-2387-7

Highly recommended

Flint, S., Enquist, L. and Racaniello, V. 2009. Principles of Virology.3rd Edition. ASM Press. ISBN 978-1555814434

Recommended

Hewlett, M. and Wagner, E. 2004.Basic Virology. Blackwell Science. ISBN 978-1405147156

Useful websites

http://www.virology.net/
http://pathmicro.med.sc.edu/book/virol-sta.htm

BIOL3405 PEST ECOLOGY AND MANAGEMENT
(3 Credits) Semester 2 Level III

Pre-Requisites: BIOL2401 Research Skills and Practices in Biology and BIOL2403 Principles of Ecology

Rationale:

A number of organisms have attained pest status and their activities are associated with huge economic losses worldwide. Pest organisms continue to invade new spaces and are responsible for or associated with varying levels of damage to horticultural crops, stored products, livestock, infrastructure, and diseases that affect humans and pets.

As a result, billions of dollars are spent annually to suppress the populations of these organisms. Unfortunately, the efforts in many developing countries, including those of the Caribbean, are based primarily on chemical control. This chemical based approach has resulted in unacceptable levels of pesticide residues in the environment, which in many instances has been magnified in the food chain and has had acute or chronic effects on many non-target species, thus threatening biodiversity.

In several instances the level of control obtained from the use of these chemicals is diminishing as several pest organisms develop resistance and where there may be acceptable levels of control, such control cannot be justified given the huge environmental cost. It has now been accepted by the international scientific community that there needs to be a shift from chemical control towards an ecologically based integrated management approach. However, such an approach requires a sound knowledge base of the ecology of the organisms that have attained pest status, the principles that guide various strategies and techniques that may form part of any attempt to manage these organisms.

The information and skills to be acquired from this course will provide a solid foundation for bridging the knowledge and skills gap in the approach to suppressing pest populations in the region.

Course Description:

The course explores the evolution of pests and the role of humans in organisms attaining pest status. Participants will be exposed to the various ecosystems in which organisms have attained pest status the ecological factors that impact on the populations of these pest species.
Field exercises provide a hands-on approach to the identification of pests, the levels of pest infection and/or infestation, and the assessment of damage and economic impact.
Critical analysis of various control strategies and an ecological approach to the selection and integration of various control strategies, that may be utilized in the management of pests, are intended to equip students with the critical thinking skills required to contribute to the development of eco-specific pest management programmes.

Learning Outcomes:

The student who successfully completes this course should be able to:

1. Describe the ecological factors that contribute to different organisms attaining pest status
2. Conduct pest surveys
3. Assess population levels and economic impact of organisms that have attained pest status
4. Outline past and present strategies for the control pest organisms
5. Formulate suitable pest management strategies for the management of pests in different ecosystems
6. Explain the legislative framework associated with the management pests
7. Demonstrate skills in assessing the efficacy of pest control strategies and pest management programmes.

Course Content:

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

Methods of Delivery:

The course will be delivered by means of audio-visual aided lectures, interactive discussion sessions and presentations by stakeholders and regulators of the pest control/management industry.
Practical exercises will involve hands-on approach to pest surveys, diagnostics and damage assessment as well as laboratory and field bioassays.
The contact hours that will be dedicated to each method are as follows:

Lectures	-	16 Hours
Practical exercises	-	30 Hours
Seminars/Discussion sessions	-	8 Hours

Methods of Assessment:

(Students are required to pass both components):

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

References:

1. **Prescribed**
   Pedigo, L. P. and Rice, M. E. 2009. Entomology and Pest Management. 6th Edition. Prentice-Hall Inc. ISBN 0-13-513295-9.

2. **Highly Recommended**
   Speight, M. R., Hunter, M. D. and Watt, A. D. 2008. Ecology of Insects: Concepts and Applications. Wiley-Blackwell. ISBN 978-1-4051-3114-8.

3. **Recommended**
   Dent, D. 2000. Insect Pest Management. CABI Publishing.

4. **Useful Websites**
   i. The Basics of Pest Ecology: www.knowledgebank.irri.org/ipm/index.../the-basics-of-pest-ecology
   ii. Agricultural Pest Genomics Resource Database: www.agripestbase.org
   iii. Urban Pests Books: www.urbanpestsbook.com
   iv. Pest Risk Analysis Unit, Ministry of Agriculture and Fisheries: www.moa.gov.jm/Services/PlantHealth/PestRiskAnalysis.php
   v. Pesticides Control Authority: www.caribpesticides.net

BIOL3406 FRESHWATER BIOLOGY
(3 Credits) Semester 2 Level III

Pre-requisite: BIOL2403- Principles of Ecology

Rationale:

Freshwater bodies are generally inland structures containing water of low salinity. Jamaica is particularly well served in terms of numerous rivers and streams which are important as sources of potable water and water for irrigation in agriculture. These freshwater bodies also contain fishes and crustaceans which are an increasingly important food resources given the decline in yield from the surrounding marine capture fisheries. Yet much less is known about the freshwater systems of Jamaica and the Caribbean in comparison to the marine habitat.

Course description:

This course introduces the student to the basic concepts, physical, chemical and biological, of freshwater habitats, as well as familiarising them with the main groups of animals and plants associated with freshwater habitats and their adaptations.
Particular emphasis is placed on the interrelationships of the fauna within communities and the on the influence of physical conditions.

The knowledge gained in this course has obvious practical application in the management of freshwater systems (employment with water authorities; the National Water Commission (NWC) of Jamaica) as well as in freshwater fisheries management and aquaculture (Dept. of Agriculture and Fisheries, private companies involved in aquaculture ventures) and in environmental protection, whether in government (NEPA) or non-government (JET,TNC) organisations or with environmental consultation companies.

Learning Outcomes:

At the end of the course students will be able to:

1. collect and interpret physico-chemical data to determine the characteristics and "health" of freshwater systems.
2. use a binomial taxonomic key to identify all common families of benthic macroinvertebrates found in Jamaican freshwaters
3. apply concepts of freshwater ecology to formulate solutions for real-life management problems such as eutrophication.

Course Content:

- Lotic habitats. Physico-chemical characteristics. Concepts of subdivision of rivers and their applicability to tropical locations. The allochthonous food web. Resilience and refuge theory.
- Lentic habitats. Stratification and lake classification. Productivity. Biomanipulation and the cascade effect. Lake benthos.
- Field based collection of material and assessment of physico-chemical data Laboratory based identification of freshwater organisms.

Method of delivery:

The course comprises 18 hours of lectures, 30 hours of practical work, split between the field and laboratory, and 6 problem-based tutorial sessions.

Course assessment:

(Students are required to pass both components)

Final theory examination (2 hours duration	50%
Coursework	50%
Comprised of:	
A laboratory report based on interpretation of the results accrued from 5 x 6 hour practical sessions	20%
Practical Examination (2 hours duration; identification of specimens, interpretation of data relating to real-life management situations)	20%
Tutorial participation (submitted responses to problem questions)	10%

Reference material:

Prescribed

Moss, B. (2010) Ecology of Fresh Waters. A View for the Twenty-first Century. Fourth edition. Wiley-Blackwell. ISBN 9781405113328

Highly recommended

Dudgeon, D. (Ed) (2008). Tropical stream ecology. First edition. Academic Press. ISBN 9780120884490

Allan JD and MM Castillo (2007). Stream ecology. Structure and function of running waters. Springer-Verlag. ISBN 9781402055829

Online resources

www.wiley.com/go/moss/ecology

BIOL3407 OCEANOGRAPHY

(3 Credits) Semester 1 Level III

Pre-requisite: BIOL2403 Principles of Ecology

Rationale: The oceans represent the largest and most prominent feature of the planet. They influence weather, control the earth's carbon dioxide and oxygen concentrations and contain some of the most productive areas on the planet. Thus they are a source of food, minerals and energy that remains largely untapped.

Knowledge of oceanography allows us to understand the marine environment, its vast untapped resources as well as its vulnerabilities. Over half of the world's population live along coastlines and are dependent on the sea for their livelihood. The progress and development of small island states like Jamaica are inextricably bound to the sea and a knowledge of the marine province and its processes will greatly enhance our lives.

Course Description:

Oceanography is an interdisciplinary approach to the study of the entire marine environment and marine phenomena. It includes the study of the structure of the sea floor and its sediments, the chemical composition and properties of sea water, the study of the movement of water in the oceans as current waves and tides and the diverse range of organisms and their adaptations to survive in the environment. The course will give students a hands-on appreciation to the importance of the marine environment which has application in Jamaica and any other island state.

Learning Outcomes:

Upon successful completion of this course students should be able to:

1. describe and evaluate the physical and chemical processes associated with the oceans
2. identify the types of organisms associated with the marine water columns- their biology, interactions and distribution.
3. investigate the organisms, habitats and processes of marine water columns through "hands on" practical exercises.
4. analyse, interpret and present oceanographic investigations in a scientific report.

Course Content:

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

Methods of Delivery:

18 hours of lecture
6 hours of tutorials infused with WAC and SAC strategies and
30 hours of laboratory and field exercises which illustrate the major aspects of the course content.

Laboratory sessions primarily involve sampling water column parameters and organisms from a boat, analysis of collected data and specimens, interpretation of findings and generation of a written report and, or oral presentation.

Methods of assessment:

(Students are required to pass both components):

One 2-hour theory examination 50%

Coursework 50%

Consisting of:

Laboratory reports (5 @ 5% each)	25%
Oral presentation of tutorial topic	5%
End of course practical test (2 hrs.)	20%

References:

1. **Prescribed:**
   Thrujillo, A. and Thruman, H. 2010. Essentials of Oceanography. 10th Ed. Prentice Hall. ISBN-10: 032166812X ISBN -13: 978-0321668127

2. **Highly Recommended:**
   Nybakken, J. and Bertness, M. 2004. Marine biology, an ecological and environmental approach. 6th Ed. Benjamin Cummings. ISBN- 0-321-03076-1

3. **Recommended:**
   Garrison, T. 2009. Oceanography: An invitation to Marine Science. 7thEdition. Benjamin Cummings. ISBN-10: 049539193X ISBN-13: 978-0495391937

4. **Useful websites:**
   http://www.onr.navy.mil/focus/ocean/
   http://life.bio.sunysb.edu/marinebio/plankton.html
   http://oceanlink.island.net/oinfo/tides/tides.html
   http://www.prospects.ac.uk/**oceanographer**.htm
   http://www.whoi.edu/

BIOL3408 COASTAL ECOSYSTEMS
(3 Credits) Semester 1 Level III

Pre-Requisite: BIOL2403- Principles of Ecology

Rationale:

As marine scientists seek to understand the earth's natural environment, coastal ecosystems which are among the most exploited areas on the planet, form an important part of the knowledge creation, resource management and sustainable development initiatives.
The aim of the course is to impart knowledge of the range of ecosystems and ecological processes associated with the tropical coastal ecosystems as well as introduce the appropriate actions employed in the protection, conservation and restoration of selected coastal environments.

Course Description:

The course describes tropical coastal ecosystems with particular reference to the wider Caribbean. Selected ecosystems will be examined and analysed to illustrate the organisms, the abiotic conditions which characterize the ecosystem. Interactions between the adjacent ecosystems will be investigated and demonstrated. At the end of this course students will be well prepared to investigate the characteristics of, and predict and mitigate changes in, coastal ecosystems.

Learning Outcomes:

Upon successful completion of the course, students should be able to:

1. identify and analyse the characteristics and components of coastal ecosystems
2. describe the physical regime and biological processes of coastal ecosystems
3. distinguish management frameworks applicable to various coastal ecosystems
4. evaluate the ecological connectivity of juxtaposed coastal ecosystems
5. analyse, interpret and present scientific investigations in a scientific report.

Course Content:

- An examination of the diversity, productivity and functions associated with:
  - beaches and dunes
  - coral reefs
  - mangroves forests
  - seagrass beds
  - estuaries and wetlands

- An examination of the range and impact of pollution affecting coastal ecosystems especially:
    - organic,
    - hydrocarbons,
    - pesticides,
    - heavy metals,
    - physical and thermal pollution
- Exercises in evaluation of:
    - coastal surveys,
    - environmental monitoring,
    - water quality ranges and criteria,
    - zoning, parks and protected areas as conservation options of coastal ecosystems.

Methods of Delivery:

18 hours of various interactive activities (UWI staff lectures, guest lectures, video presentations)
6 hours of tutorials (utilizing writing across the curriculum)
30 hours of field and laboratory exercises designed to familarise students with the natural environments as well as dominant and important organisms from those environments.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour theory examination		50%
Course Work		50%
Consisting of one 2-hour practical test	20%	
Five Laboratory and field reports (5 X 4% each)	20%	
One research topic with an oral presentation	10%	

References:

1. **Prescribed**
   Hogarth, P. 2007. The Biology of Mangroves and Seagrasses. Oxford University Press. ISBNI10: 0-19-856870-3.
2. **Highly Recommended**
   Nagelkerken, I. (Editor) 2009. Ecological Connectivity among Tropical Coastal Ecosystems. Springer-Verlag, New York. ISBN 9048124050.
3. **Recommended**
   Breton, Y., Brown, D., Davy, B., Haughton, M., and Ovares, L. 2009. Coastal Resource Management in the Wider Caribbean: Resilience, adaptation and community diversity. ISBN976-637-262-4.
4. **Useful Websites**
   www.tandfonline.co Mangrove research and coastal ecosystem studies
   www.crops.org/publications/jeq/articles/-
   www://jcronline.org/

BIOL3409 CARIBBEAN CORAL REEFS

(3 Credits) Semester 2 Level III

Pre-requisite: BIOL2403 Principles of Ecology

Rationale: Caribbean coral reefs are the foundation of the Caribbean's tourism and fishing industries, and thus account for a sixth of the region's jobs, and a third of its income (or US$ 15 billion per year), and 500,000 tonnes of its food. Caribbean reefs, however, are suffering so terribly from the effects of overexploitation, pollution and climate change that it is predicted that all the region's corals may be dead within 40 years.
Sustainably managing the region's reef resources has proved difficult because most Caribbean nationals are ignorant of the devastation to their reefs, and most reef conservation efforts are either understaffed or highly dependent on costly imported personnel. This course aims to increase the number of students with applicable knowledge of coral biology, geology and conservation methods helping to provide the region with the skilled workforce it needs to achieve the long-term conservation of its reef resources, to conduct vital new research, and to sustain economically-important, reef-dependent industries, like tourism and fisheries.

Course Description:

This course develops student competence in the biology of reef-building corals, the ecology of coral communities, and the impact of natural and anthropogenic factors on coral reefs in the context of the Caribbean region.
In addition students are introduced to the ecosystem-based approach to reef management and to the economic valuation of reefs. Throughout the course the emphasis will be on the Caribbean and the interconnectedness of reefs throughout the region, however, comparisons will be made to reefs from other regions.

Learning Outcomes:

Upon successful completion of the course, students should be able to:

1. Identify Caribbean coral species and describe their biology.
2. Categorise the major ecological interactions within coral reef communities.
3. Evaluate natural and anthropogenic threats to Caribbean coral reefs and select appropriate mitigation measures.
4. Conduct a monitoring exercise to assess reef health and interpret the data generated.
5. Construct a reef management plan using the ecosystem-based approach to management.

Course Content:

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

Methods of Delivery:

18 hours of various interactive activities (UWI staff lectures, guest lectures, video presentations)
6 hours of tutorials (utilizing writing across the curriculum)
30 hours of field and laboratory exercises designed to familiarise students with the natural environments as well as dominant and important organisms from those environments.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour theory examination	50%
Course Work	50%
Consisting of:	
One (1) in-water practical test (identification of coral reef organisms and assessment of coral condition)	10%
Five (5) Laboratory and field reports (each utilizing a different format :scientific drawings, traditional laboratory report, poster, PowerPoint presentation, video)	30%
One (1) tutorial research essay	10%

References:

1. **Prescribed**

Sheppard, C.R.C., Davy S.K. and Pilling G.M. 2009. The Biology of Coral Reefs. Oxford University Press . ISBN 978-0-19-856636-6

2. **Highly Recommended**

Humaan, P. and DeLoach, N. (2002) The Reef Set: Reef fish, reef Creature and Reef Coral. 2nd Edition. New World Publications. ISBN:1878348337, ISBN-13:978-1878348333.

3. **Recommended**

   Rohwer, F., Youle, M. and Vosten, D. (2010) Coral reefs in the Microbial Seas. Plaid Press . ISBN-10: 0982701209, ISBN-13:978-0982701201.

4. **Useful websites**

   http://www.coral.noaa.gov

   This is the homepage for NOAA's Coral health and Monitoring Program and, with its many links, is a good entry point into online information on coral reefs.

BIOL3410 WATER POLLUTION BIOLOGY

(3 Credits) Semester Level III

Pre-requisites: ZOOL 2401 Animal Form and ZOOL2402 Animal Physiology

Rationale:

All organisms need a source of potable water for survival. Humans are no exception to this, yet many authorities predict that within the next 20 to 30 years the availability of freshwater for consumption will become severely restricted. One of the major reasons for this is that the sources of water are becoming increasingly contaminated with organic and inorganic effluent making them unsuitable for use. Such contamination (pollution) also has consequences for the flora and fauna of freshwater habitats affecting biodiversity through species displacement or loss.

Jamaica, being a geologically young island is particularly susceptible to the establishment of invasive species. This "biological pollution" with habitat loss constitutes the major factor responsible for biodiversity decline.

Course description:

This course examines in detail the sources of pollutants, their constitution, and their effects on freshwater organisms both as individuals and as reflected in community composition and structure. The course also looks at the range of techniques used to monitor pollution, particularly biomonitoring processes. Ecotoxicology and public health issues are also considered. The factors which influence the success of invasive species and their consequences to aquatic biodiversity are illustrated using research carried out in the Jamaican context. The knowledge gained in this course has obvious practical application in the management of aquatic systems as well fisheries management and aquaculture and in environmental health.

Learning Outcomes:

At the end of the course students should be able to:

1. assess the condition of a freshwater body by analysing physico-chemical data collected from that location.
2. construct appropriate management plans for the mitigation of sources of contamination of freshwaters
3. conduct a biomonitoring exercise and interpret the data generated
4. assess the risk posed by, and consequences of, importation of a given exotic species to freshwater systems

Course Content:

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

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

Method of delivery:

The course comprises 18 hours of lectures, 30 hours of practical work, split between the field and laboratory, and 6 problem-based learning tutorial sessions.

Method of Assessment:

(Students are required to pass both components):

Final theory examination (2 hours duration) 50%

Coursework 50%
Comprised of:

A single laboratory report based on interpretation of the results Accrued from 5 x 6 hour practical sessions	20%
Practical Examination (2 hours duration; analytical techniques and interpretation of data relating to real-life management situations)	20%
Tutorials (submitted responses to problem questions)	10%

Reference material:

1. **Prescribed**:
   Mason, C. 2002. Biology of Freshwater Pollution. Fourth Edition Prentice-Hall (Pearson Education) ISBN 0130906395
2. **Highly recommended:**
   Taylor, E.W. (Ed.) 2009. Toxicology of aquatic pollution. Physiological, Molecular and Cellular Approaches. First edition. Cambridge University Press. ISBN 13:9780521105774
3. **Recommended:**
   Abel, P.D. 1996. Water Pollution Biology. Second Edition. Taylor & Francis. ISBN 0748406190
4. **Online resources:**
   www.ukrivers.net

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

Pre-Requisites: Approval of Head of Department

Rationale:

Research provides scientific information and theories for the explanation of the nature and the properties of the world around us. Research Projects are very effective ways of developing critical thinking skills among students through the combined processes of identifying a problem, exploring a body of literature related to the problem, formulating questions or hypotheses to solve the problem, choosing the process of conducting the research, analyzing the results in the context of the questions or hypotheses, and reporting the findings.

Course Description:

The Research Project course is designed to expose students to the processes involved in conducting scientific research. It facilitates their development from passive learner to active investigator – capable of ethical, independent research. The skills acquired are transferable to any branch of science or other professional endeavor. In the absence of such endeavours practical applications would be impossible.

Learning Outcomes:

On completion of the course students should be able to:

- Identify the feasibility of a scientific study e.g. by assessing the need to provide answers or solutions for a clearly identified problem
- Use information bases for appropriate supporting literature for a given topic.
- Formulate hypotheses for a proposed piece of scientific research, and design appropriate means for testing them.
- Collate and analyse data from their research and prepare a report in standard scientific format.
- Design and deliver an oral presentation that communicates ethical research and its outcomes.

Course Content:

- Aims and means of assessing feasibility of projects.
- Techniques in data collection, collation and analysis.
- Ethical research, experimental design, project reporting and presentation
- Scientific writing
- Investigation and written report on an approved topic.
- Multi-media-based oral presentations -remove

Methods of Delivery:

About 8 hours of interactive lectures covering the course content; about 2 hours of one-on-one tutorial sessions; multi-media-based oral presentations, and about 55 hours of student-directed research under the supervision of a qualified member of academic staff.

Methods of Assessment:

(Students are required to pass both components)

5000-word written report		75%
Oral Examination (not exceeding 30 minutes)		25%
Presentation	5%	
Knowledge & understanding	10%	
Response to questions	10%	

References:

1. **Prescribed**
   Blaxter, L, Hughes, C Tight, M 2010. How to Research. Open University Press. 4th Edition. ISBN 10:033523867X; ISBN 13:978-0335238675
2. **Highly Recommended**
   National Academy of Sciences. 2009. On Being a Scientist: A Guide to Responsible Conduct in Research: 3rd Edition. National Academies Press. ISBN 10: 0309119707; ISBN 13: 978-0309119702 (free online access).
3. **Recommended:**
   Walker, TJ How to Create More Effective PowerPoint presentations. Media Training Worldwide (October 15, 2003). ISBN 10: 1932642323; ISBN 13: 978-1932642322.
4. **Useful websites:**
   www.monash.edu.au/**research**office/human/assets/

BIOL3412 INTERNSHIP

(3 Credits) Semester 3 Level III

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

Rationale:

Internships are designed to expose students to the 'real world' where their knowledge and skills in a particular discipline can be applied. The course will provide opportunity for supervised and directed practicing of theoretical knowledge and is designed to assist students to transition easily to the working environment after graduation. The internship provides exposure to real problems and the opportunity to design on-the-job solutions.

Course Description:

The Internship course is designed to provide work experiences, to carry out specific tasks in an actual work environment related to a student's major or option. The student will be able to apply their knowledge and skills gained during the majors to actual situations and document how their training and theoretical knowledge equipped them to operate effectively in the field of work. The exposure and experience facilitate development from a learner to a 'doer' who will transition more easily to full employment status in their chosen field.

Learning Outcomes:

On completion of the course students should be able to:

- Acquire practical real-world exposure to an area of the Life Sciences related to their BSc Programme.
- Identify specific activities in which they were engaged, and articulate how these activities related to the degree, major or courses being pursued at the University
- Use theoretical knowledge and laboratory or field skills gained from individual or groups of courses to solve specific problems or function generally in a real work environment.
- Prepare an outline of recommended production practices at the host institution in which they were involved during the attachment

- Document in writing and report orally on the use and application of course-gained information and skills to the particular field of work or to solve a particular problem in the workplace.

Course Content:

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

Methods of Delivery:

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

The student is required to:

- meet regularly with the Departmental Internship Coordinator to discuss the internship experience and any work-related or logistical issues
- maintain a daily log of hours worked and a brief description of the work performed
- submit a final report summarising and evaluating the internship experience; and
- complete a résumé and interview at the Office of Placement and Career Services, UWI (Mona)

Responsibilities of the host:

- To accommodate the intern student for a minimum of 6 hours per day during the internship period of no less than six (6) weeks (total number of contact hours = 39).
- To provide opportunities for meaningful student participation during the internship period in an area or areas related to their degree.
- To provide quality supervision of the intern during the internship program.
- To provide an objective evaluation of the intern's performance in writing using the designed reporting form which evaluates: attitude, dependability, work initiative, cooperation, quality of work, adaptability,

Responsibility of the Life Sciences Internship coordinator shall be to:

- meet\correspond with students at least weekly.
- review reports from the student and host organisation
- serve as a liaison between the Department and the host organisation
- monitor the progress of the intern
- help resolve any problems the organisation and the student might have

Methods of Assessment:

Internship report (graded by the Department coordinator) which summarises the activities carried out during the internship and how it relates to the BSc programme being pursued, documentation of the main operations and structure of the host organization, evaluation of the efficiency of the enterprise, and the student's own evaluation of the experience. The daily log of activities should be included as an appendix at the end of the internship report.

Internship Report	50%
Host Evaluation	25%
Oral Presentation	25%

Orientation and guidance will be provided to the host company by the Department Internship course coordinator who will provide details of the nature of the evaluation process including the details required by the Host Evaluation form.

The Evaluation form should include assessment of:

Quality of work

Attitude

Efficiency- use of time

Ability to work independently

Ability to grasp and apply standards and procedures

Ability to make appropriate work-related decisions, with guidance
Ability to work with peers and supervisors
Adaptability
Problem solving/critical thinking skills
Punctuality, attendance
Verbal and written communication skills
Work-related skills the student developed

References:

1. **Prescribed:**
   Sweitzer, H F and King, M A 2009 The successful internship: personal, professional, and civic development. Brooks Cole; 3rd edition. ISBN-10: 049538500X ISBN-13: 978-0495385004
3. **Highly Recommended**
   Berger, L. 2012. All Work, No Pay: Finding an Internship, Building Your Resume, Making Connections, and Gaining Job Experience. Ten Speed Press. ISBN-10: 1607741687 ISBN-13: 978-1607741688
4. **Recommended:**
   Liang, J. 2006. Hello Real World!: A Student's Approach To Great Internships. BookSurge Publishing ISBN-10: 141962315X ISBN-13: 978-1419623158
5. **On-line resources:**
   www.masslifesciences.com/grants/challenge.html
   sols.asu.edu/internship/index.php
   mason.gmu.edu/~montecin/internship_requirements.html

BIOL3413 Biology Project (3 credits) NEW

Level 3 Semesters 1, 2, 3, 4.

Pre-Requisites BIOL2402- Fundamentals of Biometry, HOD approval

Rationale:

Projects are very effective ways of developing critical thinking skills amongst students through the process of identification of a problem, exploration of the body of literature related to the issue, formulation of questions or hypotheses to solve the problem, choosing the methodologies that will yield meaningful results and the process of conducting the research, analyzing the results in light of the questions or hypotheses and reporting on the findings.

Course Description:

The Biology Project is designed to expose students to the process of hypothesis formulation, experimental design and execution of an initial investigation to solve a real-life problem. It facilitates the transformation of the student from a passive learner to an active problem solver who can transition into a research scientist and someone capable of independent research.

Learning Outcomes:

On successful completion of the course students should be able to:

- Demonstrate application of the scientific method to a practical situation or problem.
- Critically review the body of literature related to the identified situation or problem
- Formulate hypotheses and design appropriate means for testing them in the process of the proposed scientific research.
- Collate and analyse data from the research and prepare and present a report.
- Interpret and discuss the results in light of existing research in the chosen area.

Course Content:

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

Methods of Delivery:

6 hours of lectures covering the course content, 3 hours of one-on-one tutorial sessions given to each student and 30 hours of student-driven research under the supervision of a member of the academic staff.

Methods of Assessment:

Project report (at least 2000 words)	75%
Oral Examination to include a 10 min Power Point Presentation	25%

References:

(a) Prescribed

Blaxter, L, Hughes, C Tight, M 2010. How to Research. Open University Press; 4th edition. ISBN-10: 033523867X ISBN-13: 978-0335238675

(b) Highly Recommended

Engineering, and Public Policy Committee on Science, National Academy of Sciences 2009. On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academies Press; 3 edition. ISBN-10: 0309119707 ISBN-13: 978-0309119702

(c) Recommended:

Walker, TJ How to Create More Effective PowerPoint presentations. Media Training Worldwide (October 15, 2003) ISBN-10: 1932642323 ISBN-13: 978-1932642322

(d) Useful websites:

www.monash.edu.au/researchoffice/human/assets/
http://wac.colostate.edu/books/thinkingwriting/
http://explorable.com/

BOTN3401 PRINCIPLES OF PLANT BIOTECHNOLOGY

(3 Credits) Semester 1 Level III

Pre-requisites: BOTN2402- Physiology of Plants OR BIOL2312- Molecular Biology 1

Rationale:

Plant biotechnology is becoming an increasingly important tool for solving some of the global problems with food and fuel supplies, conservation and ecosystem management. Gene technologies currently supplement and extend traditional breeding methods to enhance the production of food and fibre and facilitate the development of renewable biofactories, allowing the production of sustainable industrial products. Other technologies provide methods through which a balance between the economic exploitation of bioresources and their conservation can be achieved. Biotechnology, as a specialization within Biology, encompasses plant physiology, plant biochemistry and plant molecular biology and is one of the most important of the applied sciences.

Course Description:

The course will provide an overview of plant biotechnology with focus on applications in agriculture, forestry, pharmaceuticals, bio-fuels and the production of new materials. The course includes studies of plant tissue culture, gene transfer, methods of plant transformation, development and analysis of genetically modified plants, and ethical, safety, social, legal and environmental issues associated with the technology. This course will impart understanding of the basic principles of plant sciences, molecular biology and the integration of these disciplines, to provide healthy plants for food, non-food, feed and health applications. It will also give students a better understanding of the ethical, ecological and legal aspects of plant biotechnology. It further aims to equip students with skills to enable them to pursue a career in research, plant breeding or teaching related to plant biotechnology and molecular biology.

Learning Outcomes:

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

- describe the underlying principles of plant tissue culture
- explain the use of plant cell culture techniques in plant science research, agriculture and industry
- explain the principles and methods of plant genetic transformation including their specific advantages and applications in agriculture, forestry, pharmaceuticals, bio-fuels and the production of new materials;

- evaluate the ethical, ecological and legal aspects of plant biotechnology.
- devise strategies to solve problems relating to plant biotechnology by using fundamental principles in plant biotechnology and genetics

Course Content:

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

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations including problem-orientated teaching based on case studies within plant biotechnology and breeding, and15 hours of laboratory investigations based on the core material. Six tutorial sessions will adopt a problem-based learning (PBL) approach to applied aspects of plant biotechnology. (39 contact hours).

Methods of Assessment:

(Students are required to pass both components):

Final Theory Examination (2h)		60%
Coursework:		40%
Laboratory Report (2 x 7.5%)	15%	
Participation in tutorials (submission of PBL responses)	5%	
In-Course Test (1h)	20%	

References:

1. **Prescribed**
   Stewart, C. 2008. Plant Biotechnology and Genetics: Principles, Techniques and Application. Wiley-Interscience. ISBN 978-0470043813
2. **Highly recommended**
   Chawla H. 2009. Introduction to Plant Biotechnology.3rd edition. Science Publishers. ISBN 978-1578086368.
3. **Recommended**
   Slater, A., Scott, N. and Fowler, M. 2003. Plant Biotechnology; The Genetic Manipulation of Plants. Oxford University Press. ISBN: 0-19-925468-0
4. **Useful websites**
   http://aggie-horticulture.tamu.edu/tisscult/biotech/biotech.html
   http://www.ncbe.reading.ac.uk/NCBE/GMFOOD/technology.html

BOTN3402 PLANT BREEDING

(3 Credits) Semester 1 Level III

Pre-requisites: BIOL2404 Molecular and Population Genetics

Rationale:

Plant Breeding is necessary for increasing agricultural productivity in any country. An education in plant breeding is both challenging and highly interdisciplinary, the purpose of which is to develop a working synthesis of information from a wide array of subjects such as ecology, evolution, applied statistics, entomology, plant pathology, and molecular biology amongst others.
Rapid developments in the fields of genetics and molecular biology are bringing powerful new tools to the aid of the plant breeder in order to improve performance and stability of new varieties of field crops as well as fruit and vegetable crops.
A general trend in the plant breeding research has seen the expansion of the traditional national research focusing on the local breeding problems which are being addressed at the international level especially through the consultative group on international agricultural research (CGIAR system).
This course will focus the crop improvement issues at the local and regional crops used in agricultural and horticultural industries.

Course Description:

This course will expose students to the achievements of plant breeding efforts from several countries and crops; discover the genetic basis of crop plant phenotypes; explore the wild and domesticated

ancestors of our modern field crops as well as fruit and vegetable crops; design improvement strategies for self-pollinating, cross-pollinating and asexually propagated crops; run, work in a successful crop breeding program; develop molecular tools that will directly assist in the crop breeding process; formulate conservation strategies of the world's crop biodiversity through gene/germplasm banks.

Learning Outcomes:

The learning outcomes addressed in this course include identification of forms of scientific enquiry, demonstrate depth and breadth of the subject area and independence of thought.

After successful completion of this course students should be able to:

- design crop breeding strategies in agricultural/horticultural industries to increase crop production and profitability for the growers,
- use plant breeding to mitigate the impact of pests and diseases avoiding pesticide damage to the environment,
- formulate crop breeding methods in the development of sustainable agricultural production systems that would satisfy the ever increasing human population's demand for food, fiber and plant based industrial products.

Course Content:

This course will include the following topics:

- Plant domestication and crop evolution;
- reproduction in crop plants;
- inheritance of quantitative characters and plant breeding;
- breeding self-pollinated crops;
- breeding cross-pollinated and clonally propagated crops;
- breeding hybrid varieties by manipulation of fertility regulating mechanisms;
- breeding for biotic and abiotic stress factors;
- polyploidy and plant breeding;
- germplasm resources, gene banks and conservation;
- new variety testing, release, maintenance and seed production; and
- molecular breeding.

Methods of Delivery:

The teaching of this course will be carried out using the following strategies:

	Contact Hours	Quality Hours
Lectures [interactive, including relevant videos, multimedia presentations]	18	18
Laboratory exercises of plant breeding data collection, analysis and interpretation (and field trips)	30	15
Tutorials [including videos, case studies of regional crops]	6	6
Total	54	39

Methods of Assessment

(Students are required to pass both components):

One Theory Examination (Two Hours)		60 %
Course Work:		40 %
One Practical Examination (Two Hours)	20 %	
One Midterm Examination (One Hour)	10 %	
Laboratory Reports (5 x 2 %)	10 %	

References:

1. **Prescribed**
   Sleper D. A. and Poehlman, J. M. 2006. Breeding field crops (5th Edition). Blackwell Publishing, ISBN-10: **0813824273** ISBN-13: **978-0813824277**
2. **Highly Recommended**
   Allard, R. W. 2009. Principles of Plant Breeding. Publisher: Wiley. 2nd Edition **ISBN-10:** 0471023094; **ISBN-13:** 978-0471023098
   Simmonds, N. W. 2007. Principles of Crop Improvement. Second Ed. Blackwell Science. ISBN 0 632 04191 9
3. **Recommended**
   Fehr, W.R. 1987. Principles of Cultivar Development. Vol 1 & 2. Macmillan Pub Co, New York. **ISBN-10:** 0070203458 **ISBN-13:** 978-0070203457
4. **Useful Websites**
   The Global Partnership Initiative for Plant Breeding Capacity Building (GIPB)
   http://km.fao.org/gipb/
   The Consultative Group on International Agricultural Research
   http://www.cgiar.org/

BOTN3403 FUDAMENTALS OF HORTICULTURE
(3 Credits) Semester 2 Level III

Pre-requisites: BOTN2401 Plant Form and Systematics and BOTN2402 Physiology of Plants

Rationale:

This course is designed to give a basic understanding of the importance of horticulture, and the application of horticultural practices to crops and ornamentals, their propagation and their management for use in the practice of broaden horticultural and soil sciences. The course is also designed to provide a training and coordination skills on horticulture and will serve motivated horticultural students seeking graduate-level training for professional positions in terms of time and skills.
This course is needed because of the importance of crops production in the economy and human development, as well as in the social life (ornamentals and landscaping). Fundamental and applied horticulture is also needed because it reflects the continuity of botany and its translocation from a descriptive to an applied field.

Course Description:

The course presents fundamental concepts underlying the science of crops and ornamentals production and management, including abiotic and biotic environmental factors relative to their effects on plant physiology. This course will give students an understanding of plants, plant growth requirements, geographic distribution of major plant types, the importance of soil, climate, topography and other factors on plant growth, pest control, food crops, landscape plants, floriculture, soil degradation, control, and the impact of plants on the social structure.

Learning Outcomes:

On completion of the course students should be able to:

- utilize scientific nomenclature used in horticulture
- explain the effect of environmental factors on plant growth,
- explain plant propagation techniques and propagate plants,
- select plants suitable for propagating by suitable asexual method (herbaceous, softwood, hardwood, and leaf),
- carry out tissue culture procedures,
- describe ripening, harvesting and storage technologies of fresh crops including flowers,
- identify and give the economic importance of fresh crops and ornamentals in different regions,
- examine the major objectives of landscaping,
- appraise the use of computers in horticultural science

Course Content:

- Horticultural Plants (as distinct from routine agricultural plants): morphology, taxonomy, environmental physiology
- Propagation of Horticultural Plants
  - Sexual propagation

    - Seed production and certification, methods of seeding, seed nursery, transplantation
    - Asexual propagation: cuttings, grafting, budding, layering, specialised underground structures, micropropagation
- Nursery Management
- Controlled Environment Horticulture
    - Greenhouse design and construction
    - Internal environment control
    - Light, irrigation, temperature, humidity, substrate, pot and bed culture
- Out-door Environment Horticulture: principles of landscaping, nursery production, bedding plants, ground cover/grasses, trees and shrubs
- Growing Garden Crops: ornamentals, vegetables, herbs, fruit trees
- Post-Harvest Handling and Marketing of Horticultural Produce
- Computers in Horticulture

Methods of Delivery:

Course delivery includes the reading and evaluation of research papers by the students, interactive tutorial sessions (6 contact/credit hrs.), collaborative laboratory and field work as well as site visits (30contact/15 credit hrs.). Instructional support for these activities will be complemented through 18 contact/credit hours of lectures.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour theory examination		50%
Course work		50%
Consisting of one 2-hour practical test	20%	
Laboratory (10%) and field trip report (5%)	15%	
Research (10%) and oral presentation (5%)	15%	

References:

1. **Prescribed**
   Acquaah, G. 2004. Horticulture: principles and practices (3rd edition). Pearson/Prentice Hall, NY. ISBN 13: 978-0-13-159247-6, ISBSN-10: 0-13-159247-5
2. **Highly Recommended**
   Rice, L.W. and Rice, R.P. 2010. Practical Horticulture Prentice Hall, NY**.** ISBN: 0-13-118930-1
3. **Recommended**
   Adams, C.R., Bamford, K.M. and Early M.P. 2004. Principles of Horticulture Butterworth-Heinemann, Elsevier, Amsterdam. ISBN: 978-0-7506-8694-6
   Adams, C.R. 2011. Principles of Horticulture Routledge Publisher, Oxon**.** ISBN-10: 0080969577, ISBN-13: 978-0080969572.
4. **Useful Website**
   http/www.horticulture.psu.edu

BOTN3404 ECONOMIC BOTANY

(3 Credits) Semester 2 Level III

Pre-requisites: BOTN2401 Plant Form and Systematics; BOTN2402 Physiology of Plants

Rationale:

Within the context of our rich yet fragile botanical heritage and evolving economy, the demand for more critical and creative approaches to the sustainable utilisation of our plant resources has never been more pronounced. A thorough knowledge of the intimate relationship between plants, their products and the lives of humans will facilitate greater positive impact on the environment, society, lifestyle and welfare of the island.

This course is designed to develop a critical awareness in students of the economic and ethnobotanical aspects of plant biology, facilitating a greater understanding of the tremendous impact on the social and economic opportunities to be generated from such awareness. This is intended to

stimulate the graduate to be a socially responsive innovator with entrepreneurial interests, facilitating more strategic sustainable utilisation of the botanical resources of Jamaica and revolutionizing the values and attitudes toward plant resource utilization.

Course Description:

Critical thinking and creativity within a scientifically ethical framework are skills promoted through the learning experiences throughout the integrative and collaborative laboratory sessions, field work and consultative learning experiences. Students will be required to develop and execute laboratory investigations on non-food plant utilisations and then effectively communicate experimental findings and evaluate results from simulations during learning activities.

Learning outcomes:

Upon successful completion of this course the students should be able to:

1. identify and assess the economic importance of commonly occurring plants.
2. evaluate the hypotheses on the origin and evolution of agricultural crops.
3. analyse the relationships involved in the anthropological incorporation of plant resources.
4. assess the potential pharmaceutical, social and industrial importance of plant secondary metabolites.
5. illustrate the ways in which plants may be sustainably exploited to facilitate human health and welfare.
6. setup laboratory investigations to assess the efficacy of plant extracts as antimicrobials.
7. analyse and interpret data generated from laboratory investigations as well as published research on the pharmaceutical activity of secondary plant metabolites.
8. communicate experimental findings orally and in writing in a concise and scientifically coherent manner.

Course Content:

1. Plant families of medicinal and economic importance
2. Origin of agriculture
3. Ethnobotany:
    a. Medicinal Plants:
        - Herbs and spices
        - Phytochemicals
        - Nutraceuticals
        - Aromatherapy
        - Conventional and Alternative Medical Systems
            - » Naturopathy
            - » Integrative medicine
            - » Eastern methods

    b. Social uses of plants:
        - Fumitories
        - Masticatories
        - Ethnic, cultural & religious influences on plant usage
            - » Plant Products: flavours and fragrances, gums, resins, oils, fibres
            - » Under-utilized tropical plant food
            - » Timber and non-timber forest products
            - » Economic uses of algae, bryophytes and pteridophytes
            - » Conservation of medicinal and economically important plant genetic resources.

Methods of delivery:

Course delivery includes the reading and attendant evaluation of research papers in tutorials by the students, interactive tutorial sessions (6 credit hrs.), case studies, audiovisual documentary material, collaborative laboratory and field work as well as site visits (15 credit hrs.). Instructional support for these activities will be complemented through 18 credit hours of lecture-discussion approaches.

Methods of Assessment:

(Students are required to pass both components):

Final Theory examination (2 hrs) 40%

Coursework assessment		60%
Composed of:		
Laboratory reports (3 x 5%)	15%	
Field project	10%	
Oral presentation & tutorials	15%	
2-hour in-course test (theory and practical)	20%	

References:

Prescribed:

1. Levetin, E. & McMahon, K., 2011. Plants & Society. McGraw-Hill. ISBN-10: 0073524220 | ISBN-13: 978-0073524221.

Highly Recommended:

1. Heinrich, M., Barnes, J., Gibbons, S. and Williamson, E., 2004. Fundamentals of Pharmacognosy and Phytotherapy (6th edition). Churchill Livingstone. ISBN-10: 0443071322, ISBN-13: 978-0443071324
2. Daniel, M., 2006. Medicinal Plants: Chemistry and Properties. Science Publishers. ISBN-10: 1578083958, ISBN-13: 978-8120416895.
3. Simpson, B. and Ogarzaly, M., 2001. Economic Botany. McGraw-Hill. ISBN-10: 0072909382, ISBN-13: 978-0072909388.

Recommended:

1. Lowe, H, Payne-Jackson, A., Beckstrom-Sternberg, M. and Duke, J. 2001. Jamaica's Ethnomdicine: Its Potential in the Healthcare System. Pelican Publishers. ISBN: 9766103615
2. Payne-Jackson, A., 2004. Jamaican Folk Medicine: A Source of Healing. University of the West Indies Press. ISBN-10: 9766401233, ISBN-13: 978-9766401238.
3. Warner, M., 2007. Herbal Plants of Jamaica. Macmillan Education. ISBN-10: 1405065664, ISBN-13: 978-1405065665.

Useful Websites:

1. http://www.botgard.ucla.edu/html/botanytextbooks/economicbotany/index.html
2. http://www.ars-grin.gov/duke/
3. http://www.greenpharmacy.com/
4. http://www.ethnoleaflets.com/

BOTN3405 PLANT ECOPHYSIOLOGY

(3 Credits) Semester 2 Level III

Pre-requisites: BIOL2402 Fundamentals of Biometry; BIOL2403 Principles of Ecology

Rationale:

Within the discipline of plant science there is a mystery concerning the physiological adaptations which enable selected species to establish, survive and succeed in every habitat on the planet. While survival in the tundra and desert is often seen as extreme, the ecophysiology of tropical plants is relevant for any student of biology, ecology, geography, agriculture and forestry since plant physiological ecology can be found at the levels of biochemistry, molecular biology, as well as whole plant physiology.

Course Description:

The course describes the range of physiological specializations demonstrated by plants as they colonise the range of environments across the world. Tropical plants receive special focus as these plants are responsible for the start of most tropical ecosystems, much of the agriculture in feeding the world, especially in harsh climatic conditions. At the end of this course students should be able to critically evaluate their knowledge of plants and re-examine them as highly specialized physiological species evolved over time to combat climate, location and even the consequences of modification for human needs.

Learning Outcomes:

Upon successful completion of the course, students should be able to:

1. identify and describe the physiological characteristics of plants found in the tropics
2. investigate interactions between plant species and their various locations and climatic zones
3. describe and explain the physiological function facilitated by specific anatomical adaptations of selected plants

4. evaluate the growth, reproduction and geographical distribution of plants as influenced by their physiological ecology
5. analyse, interpret and present ecophysiological investigations in a laboratory or field report.

Course Content:

An examination of the physiological adaptations of tropical plants to their environments using the following as examples:

- Tropical Forests (the physiology of nutrient cycling and photosynthetic plastic response)
- Epiphytes and Lianas (the physiology of foliar absorption)
- Mangroves and salinas (the physiology of water uptake and salt extrusion)
- Aquatic habitats (respiration and photosynthesis underwater)
- Savannas, deserts and dunes (the physiology of C3, C4 CAM, CAM shifting and CAM idling)

Methods of Delivery:

Course delivery includes the reading and attendant evaluation of research papers in tutorials by the students, interactive tutorial sessions (6 contact/credit hrs.), collaborative laboratory and field exercises to illustrate the principles of physiological ecology of selected plants. (30 contact/15 credit hrs.). Instructional support for these activities will be complemented through 18 contact/credit hours of lectures.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour Theory Examination		50%
Course Work		50%
Consisting of one 2-hour practical test	20%	
Five Laboratory and field reports (5 x 4%)	20%	
One research project (group) with an oral presentation	10%	

References:

1. **Prescribed**
   Luttge, U. 2008. Physiological Ecology of Tropical Plants. Springer Heidelberg Dordrecht, London ISBN 3-540-61161-4
2. **Highly Recommended**
   Lambers, H., Chapin, F.S., Pons. T.L. 2007. Plant Physiological Ecology. Springer Heidelberg Dordrecht, London ISBN 10- 0387983260
3. **Recommended**
   Larcher, W. 2009. Physiological Plant Ecology. Springer Heidelberg Dordrecht, London ISBN 10-3540423166
4. **Useful Websites**
   http://kbd.kew.org/kbd/ Kew Royal Botanical Gardens
   http://www.functionalecology.org

BOTN3406 TROPICAL FOREST ECOLOGY

(3 Credits) Semester 1 Level III

Pre-requisite: BIOL2403 Principles of Ecology

Rationale: Tropical forest ecosystems cover less than two percent of Earth's surface, yet they account for more than half of global biodiversity. They are found in 85 countries in the world and are important reservoirs for endemic biodiversity. They also provide essential ecosystem services (such as potable water, fisheries, etc.) that directly support more than one billion people living in extreme poverty. Yet, paradoxically, human actions trigger biodiversity loss, by widespread transformation of highly diverse natural ecosystems to relatively species poor managed ecosystems, which consequently affects the quantity and quality of ecosystem services.

Global climate change is predicted to compound the effects of deforestation by causing profound environmental changes such as sea-level rise, increases in surface temperature, severe fluctuations in the quantity of rainfall, and an increase in the frequency and intensity of natural disasters such as hurricanes, flooding, and droughts. It is now clear that the impact of climate change will greatly exacerbate existing assaults on natural ecosystems.

Forest ecology is a scientific discipline that seeks to provide a greater understanding of the ecology, interrelated patterns and processes of different components of forest ecosystems. This information is required to develop and guide scientifically-based management and conservation strategies.

Course Description:

The course provides an overview of floristics, structure and regeneration dynamics of tropical forests world-wide. The course also covers the important services provided by these ecosystems such as their role in the hydrological and nutrient cycles. The course covers the impacts human activities such as deforestation, habitat fragmentation and global climate change on tropical forest ecosystems. Additionally, the course covers different ways in which the services provided by these ecosystems can be valued.

Learning Outcomes:

Upon successful completion of this course the students should be able to:

- distinguish between different forest types, where they occur and how environmental factors influence forest type
- appraise the role of natural disturbance in forest dynamics and the maintenance of species diversity
- explain the importance of forests in the hydrological and nutrient cycles and the effects of anthropogenic disturbance on these cycles.
- assess how deforestation and habitat fragmentation affects tropical forest diversity.
- assess the value of tropical forest ecosystems
- critically evaluate the postulated impacts the postulated impacts of global climate change.

Course Content:

1. Origins of tropical rain forests
2. Origins of tropical forest diversity
3. Characteristics of tropical rain forests
4. Tropical rainforest formations
5. Tropical dry forests
6. Reproductive ecology of tropical rain forest trees
7. Reproductive ecology of tropical dry and moist forest trees
8. Principles of tropical forest hydrology
9. Tropical forest nutrient cycles
10. The effects of deforestation and habitat fragmentation
11. Payments of ecosystem services and REDD (reducing emissions from deforestation and forest degradation)
12. Global climate change and tropical forest ecosystems

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations, with 30 hours of field-based based demonstrations and practical exercises focused on relevant (local) examples of forest ecology and 6 hours of tutorials/discussion sessions exploring the application of theoretical knowledge to solving problems related to effective conservation of forest habitats.

Methods of Assessment:

(Students are required to pass both components):

One 2-hour theory examination		60%
Coursework consisting of:		40%
Written review of a research topic	10%	
Fieldwork reports (3 x 10%)	30%	

References:

Prescribed

Whitemore, T. C. 1998. An Introduction to Tropical Rain forests. ISBN-10: 0198501471 | ISBN-13: 978-0198501473 Edition: 2

Richards, P. W. 1996. The Tropical Rain Forest (2nd Edition). ISBN-10: 0521421942 | ISBN-13: 978-0521421942

Longman, J. and Jenik, K. A. 1989. Tropical Forest and its Environment. ISBN-10: 0582446783 | ISBN-13: 978-0582446786

ZOOL3403 ENTOMOLOGY
(3 Credits) Semester 2 Level III

Pre-requisite: BIOL 2401 Research Skills and Practices in Biology

Rationale:

Insects are the dominant group of animals, dominating every ecosystem except the marine environment. Consequently, they significantly affect aspects of human endeavour including agriculture, health management, and environment conservation. For example insects cause diseases, resulting from simple phobias, discomfort and pain, to transmission of pathogens resulting in sickness and even death. Insects are also becoming important in non-traditional areas such as forensic science, as well as tourism and other forms of recreation.

Course Description:

This course explores the science of Entomology, focusing on morphology, development, ecology, taxonomy, and diversity. Examples of how insects have influenced human populations will be examined.
Field trips provide opportunities to study insects in their natural habitats.
This course provides a foundation for individuals involved in pest management, parasitology, fresh water biology, management of terrestrial biodiversity. The course further aims to equip students for careers in agriculture, pest management, biodiversity conservation, the health sector, forensic science.

Learning Outcomes:

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

- identify insect to the level of family.
- describe the biology of the different insect orders and the major families within these orders.
- predict the likely outcomes of interactions with various groups including other insects, humans and plants.
- apply the basic biological principles necessary for the management of both harmful and beneficial insects in relation to various human activities.

Course Content:

- Biology of the insects including external and internal morphology in relation to taxonomy and evolution, life histories, social organizations where applicable, place in biosphere.
- Diversity of the insects including: taxonomy, an order-by-order survey with emphasis on Caribbean fauna and economically important groups.
- Examples of harmful groups including pests and vectors.
- Examples of beneficial taxa, such as those important for pollination, natural control of populations, and ecotourism.

Practical component:
Laboratory exercises to study basic morphological structures as well as modifications; Exercises in taxonomy including use of binomial keys; Practice of techniques in the collection and curation of insects.
Field trips to practice and evaluate various techniques; opportunities to collect insects and study their adaptations to a wide variety of habitats

Methods of Delivery:

This course will be delivered by means of 18 interactive, multimedia presentations; 18 hours of laboratory exercises designed around the key aspects of the course; 12 hours of field work which will explore different observational and collecting techniques; 6 hours of tutorials. Students will also make an insect collection which will provide training in collection, classification and curation procedures.

Course Assessment:

(Students are required to pass both components):

Final Theory Examination (2hr)		50%
Coursework:		50%
Insect Collection (curated collection of 50 insects, with examples from the major taxa)	25%	
Laboratory reports (3)	15%	
Oral Examination (20 minutes, insect collection	10%	

to form core from which questions on classification, biology and other aspects of the course will be developed).

Reference Material:

1. **Prescribed**
   Pedigo, L. P. and Rice, M. E. 2009. Entomology and Pest Management. 6th Edition. Prentice-Hall Inc. ISBN 0-13-513295-9
2. **Highly recommended**
   i. Borrow, D.J. and White, R.E. 1970. A Field Guide to Insects America north of Mexico. (1970) Houghton Mifflin. ISBN 0-395-91170-2.
   ii. Tripplehorn, C.A. and Johnson, N.F. (2005) Borrow and DeLong's introduction to the study of insects. 7th Edition. Thompson Books/Cole. ISBN 0-03-096835-6
   iii. Richards, O.W. and Davies, R.G. Imm's general textbook of Entomology. 10 Edition. (1984). Chapman and Hall. Vol. 1. ISBN 0-412-15210 x. Vol. 2. 0-412-15230-4
3. **Online resources**
   http://bugguide.net

ZOOL3404 PARASITOLOGY
(3 Credits) Semester 1 Level III

Pre-requisites: ZOOL 2401- Animal Form **and** ZOOL2402- Animal Physiology

Rationale:

Despite major advances in our understanding of parasites, parasitic diseases continue to negatively impact human and animal health - about 15 million people still die each year due to infectious diseases; nearly all live in developing countries. Among the six diseases considered most detrimental to human health by the World Health Organization, five are caused by parasites and are vector-borne. Hence, a working knowledge of the diagnosis, transmission, pathology and control of parasites is essential to our understanding of parasitic infections in humans and domesticated animals, the diseases they cause, and how to control them.

Course Description:

This course will provide core training in the theoretical and practical aspects of parasitology, covering the protozoan and metazoan parasites of humans and selected domesticated animals, and the vectors which transmit them. The course includes studies of the morphology, lifecycle, diagnosis, transmission, pathology and control of parasites. It further aims to equip students with skills to enable them to pursue a career in research, control or teaching related to medical or veterinary parasitology.

Learning Outcomes:

At the end of the course, students will be able to:

- identify the major types of protist, helminth and arthropod parasites of man and selected domestic animals;
- describe life cycles and transmission features of different protozoan and metazoan parasites;
- derive likely pathological outcomes from parasite life cycle details;
- propose basic control strategies for parasitic infections.

Course Content

1. Fundamental concepts of parasitology; morphology, lifecycle, transmission, pathology and control of selected protist, helminth and arthropod parasites of humans and domesticated animals; laboratory diagnostic techniques; parasite ecology and evolution; parasite immunology; epidemiology of soil-transmitted helminth (STH) infections in the Caribbean region
2. Laboratory-based exercises to include recognition and diagnosis of a range of parasitic infections of humans and domesticated animals.

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations, with 30 hours of laboratory-based investigations based on the core material. Six (6) tutorial sessions will adopt a problem-based learning approach to applied aspects of parasitology. ((39 contact hours).

Course Assessment:

(Students are required to pass both components)

Final Theory Examination (2h)		50%
Coursework:		50%
Laboratory Reports (10 x 3%)	30%	
Participation in tutorials (submission of PBL responses)	5%	
Comprehensive Examination (using visual media) (2h)	15%	

Reference Material:

1. **Prescribed**
   Roberts LS and Janovy J (2009). Gerald D. Schmidt and Larry S. Roberts' Foundations of Parasitology. 8th Edition. McGraw-Hill Science/Engineering/Math. ISBN-10: 0073028274
2. **Highly recommended**
   Marquardt WC, Demaree RS and Grieve RB (2000). Parasitology and vector biology 2nd Edition. Academic Press. ISBN 0124732755, 9780124732759
3. **Online resources**
   http://www.med.sc.edu:85/book/parasit-sta.htm

ZOOL3405 VERTEBRATE BIOLOGY

(3 credits) Semester Level 3

Prerequisites: ZOOOL2401 Animal Form **and** ZOOL2402 Animal Physiology

Rationale: There can be little doubt that vertebrates are among the most important and successful animals on the planet. Vertebrates are important to humans as sources of food, particularly animal protein, an adequate supply of which is essential for normal growth. In the ecological sense, vertebrates dominate food chains in most habitats. They are usually the top predators and thus have a pivotal role in controlling populations at lower trophic levels.
Vertebrates occur in all habitats and in most locations. Vertebrates are important as animal models for medical research In addition, of course, humans are vertebrates. The knowledge gained in this course has obvious practical application in all aspects of animal management, in terrestrial, freshwater and marine ecology and in conservation of biodiversity.

Course description:

This course introduces students to the key elements of vertebrate biology by examining the origins and evolution of the group and looking in detail at the unique characteristics of each of the five main classes of vertebrates. The course adopts an integrated approach combining ecology, behaviour, physiology, and morphology to present a view of vertebrates as functioning systems. Adaptation to the environment is emphasised as is the diversity of body form and structure within each group. The economic significance of the various vertebrate groups is also examined in detail.

Learning Outcomes:

At the end of the course students should be able to:

1. differentiate organisms from the five main vertebrate classes based upon their morphological characteristics
2. categorize vertebrates based on their general morphology and selected aspects of their biology.
3. appraise feeding strategies of vertebrates from study of their morphology
4. apply knowledge of vertebrate biology to formulate animal management practices

Course Content:

- Vertebrate relationships and basic structure.
- Diversity and radiation of fishes.
- Radiation of tetrapods.
- Avian specializations.
- Radiation and diversity of birds.
- The evolution and biogeography of mammals.
- Mammalian characteristics, specializations and diversity.
- Aquatic mammals. Primate evolution.
- Ecology and social behaviour of mammals and birds.
- Herbivory.

- Reproductive strategies and population dynamics of vertebrate populations.
- Commensal vertebrates and vertebrate pests.

Field and laboratory-based exercises including, ecomorphology of fishes, lizard behaviour, composition of bird communities in different habitats, mammalian feeding strategies.

Method of delivery:

The course comprises 18 hours of lectures, 30 hours of practical work, split between the field and laboratory, and 6 problem-based learning tutorial sessions

Course assessment:

(Students are required to pass both components):

Final theory examination (2hours)		60%
Coursework:		40%
Group presentation	20%	
Laboratory report (5x3marks)	15%	
Tutorial participation (submitted responses to problems)	5%	

References:

Prescribed

1. Kardong, K.V. 2012. Vertebrates. Comparative anatomy, Function and Evolution. Sixth Edition. McGraw-Hill. ISBN 9780071086554
   OR
2. Pough, F., Janis, C. and Heiser, J. 2008. Vertebrate Life 8th Edition. Pearson. ISBN13: 9780321600790 ISBN10: 0321600797

Highly recommended

Walker, W., Liem, K., Bernis, W. and Grande, L. 2001. Functional Anatomy of the Vertebrates. Third Edition. Harcourt College. ISBN 0030223695

Online resources

http://highered.mcgraw-hill.com/sites/0072528303/

ZOOL3406 IMMUNOLOGY

(3 Credits) Semester 2 Level III

Pre-requisites: ZOOL 2401 Animal Form and ZOOL2402 Animal Physiology

Rationale: Immunology is a rapidly developing discipline within the field of biomedical science. Essential to our understanding of immunology is a functional appreciation of how immune components, pathogens and tumors interact; how the system develops and is regulated; and the pathologic mechanisms by which the immune system causes damage.
Over the years, the efforts of scientists working on the immune system have led to the recognition of immunology as a complete and extensive discipline of medicine; however the borders of immunology as a discipline overlap with many other clinical and basic sciences. Hence, immunologists operate in many different areas of biomedical research, as well as in healthcare, agriculture and environmental monitoring.

Course Description:

Immunology covers all aspects of the immune system. It deals with the physical, chemical and physiological characteristics of the components of the immune system; in the physiological functioning of the immune system in states of both health and disease; and malfunctions of the immune system in immunological disorders (autoimmune diseases, hypersensitivities, immune deficiency, transplant rejection). This course is designed to present the principles of immunology in a concise and easily comprehendible form, and to highlight the major functional operations and applications of immune responses.

Learning Outcomes:

At the end of the course, student will be able to:

- Explain the basic principles in immunology (e.g. specificity, memory, adaptiveness, and discrimination);
- Apply knowledge of the role of immune responses to real life situations (e.g. transplantation, allergy, autoimmunity, HIV infection, vaccination, etc.)

Course Content:

1. Basic Immunology
   Components of innate and acquired immunity; immunogens and antigens; antibody structure and function; antibody-antigen interactions; the complement system; ontogeny of immune cells; triggering the immune response; the major histocompatibility complex in immune responses; control mechanisms in the immune response
2. Immunity in action
   Immunoassays, hypersensitivity reactions, disorders of the immune response, HIV infection, autoimmunity, transplantation immunology, tumor immunology
3. Laboratory work
   Histology of lymphoid organs of the mouse; viable counts of splenic lymphocytes; precipitation & agglutination reactions; diagnostic immunology; problem-based learning exercises, etc.

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations, with 30 hours of laboratory-based investigations based on the core material. Six (6) tutorial sessions will adopt a problem-based learning approach to applied aspects of immunology.
(39 credit hours).

Course Assessment:

(Students are required to pass both components):

One 2-hour theory examination		50%
Coursework:		50%
One 2-hour MCQ end of course paper	20%	
Laboratory reports (5 x 6% each)	30%	

Reference Material:

1. **Prescribed**
   Coico, R. & Sunshine, G. 2009. *Immunology: a short course*. Sixth edition. Wiley Blackwell. ISBN-10: 0470081589 ISBN-13: 978-047008158
2. **Highly Recommended**
   Kindt, T.J., Osborne, B.A. and Goldsby, R.A. 2006. *Kuby Immunology*. Sixth Edition. WH Freeman & Co. ISBN-10: 1429202114 | ISBN-13: 978-1429202114.
3. **Online Resources**
   University of South Carolina School of Medicine:
   http://pathmicro.med.sc.edu/book/immunol-sta.htm
   British Society for Immunology:
   http://www.immunology.org/page.aspx?pid=1262

ZOOL3407 HUMAN BIOLOGY

(3 Credits) Semester 1 Level III

Pre-requisites: ZOOL2401 Animal Form AND ZOOL2402 Animal Physiology

Rationale:

Life science is an interdisciplinary area concerned with the study of living organisms and the ecosystems in which they are found. The study of the human organism is an integral part of the life sciences, hence it is essential that scientifically literate people are fully aware of themselves as *Homo sapiens* ('wise man'), and understand their relationships with other living organisms and the environment: Knowledge of how we function, our evolution and our unique ecology is key to this process.

Course Description:

The course covers the main aspects of human biology, evolution and ecology. Through a combination of principles and research, the student will be exposed to human structure, function, evolution, the causes of abnormalities, and consequences of human activity (e.g. on the environment), normative ethics, etc. The successful student will be better equipped to pursue careers in the public services or the environment.

Learning Outcomes:

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

- Discuss the basic functional features of the human organism
- Explain human evolution and the similarity of humans to other life forms
- Analyze human heredity and reproduction in the context of molecular genetics, genetic engineering,
- Evaluate the effect of humans on the environment
- Expound normative and environmental ethics

Course Content:

- Human identity
- Human development
- Human functional systems
  - Musculo-skeletal
  - Neuro-sensory
  - Metabolic
  - Respiration
  - Circulatory
  - Urinary
  - Reproductive
  - Immune
- Abnormalities e.g. cancer, congenital, autoimmune
- Human heredity and genetics; aging
- Human evolution
- Man and the environment
- Normative ethics; environmental ethics

Methods of Delivery:

The course will be delivered by means of 24 interactive, multimedia presentations. A supervised, library-based project (30 hours = 15 quality hours) will focus on an applied aspect of the human organism e.g. human identity, human development, basic functions, learning, physical or mental health, human evolution, humans and the environment, normative ethics, etc.

Course Assessment:

(Students are required to pass both components)

One 2-hour theory examination	50%
Project Written Report (minimum 3,000 words)	50%

Reference Material:

1. **Prescribed**
   Chiras, D.D. 2002. Human Biology: Health, Homeostasis and the Environment. 4th edition. Jones and Bartlett Publishers. ISBN-0-7637-1880-7
2. **Highly Recommended**
   Harrison, T. and Johnson, J. 2010. The human organism: function and form . Kendall Hunt Publishing. ISBN-10: 075751376X; ISBN-13: 978-0757513763
3. **Online Resources**
   www.project2061.org/publications/sfaa/online/chap6.htm
   http://biology.jbpub.com/book/humanbiology/

ZOOL3408 SUSTAINABLE USE OF MARINE FISHABLE RESOURCES

(3 Credits) Semester 2 Level III

Pre-requisites: ZOOL 2401 Animal Form and ZOOL2402 Animal Physiology

Rationale:

With human populations at record highs, protein demand is increasingly leaning toward the oceans. However, living marine resources are mainly overexploited. So how can we obtain valuable and healthy food supplies from our oceans and do this sustainably? There is tremendous need for a course like this for Jamaica and the Caribbean. This course responds to the need for a graduate with grasp of marine ecosystems and the sustainable utilization and management of the resources in them.

Course Description:

The course will cover the fish biology, assessment of world fisheries resources and their status and the use of modeling software as part of modern assessment methods for fishable resources. Examples will be taken from world fisheries with focus on Caribbean fisheries and the application of modern fisheries management principles to achieve sustainable yield.

Learning Outcomes:

Upon completion of this course students should be able to:

- Analyze and categorize the major marine fishable resources
- Classify and describe the biology of the major groups of organisms included under Marine Fishable resources
- Analyze and explain marine fisheries challenges,
- Describe and critically analyze the operations of modern fisheries
- Apply the methods of stock assessment and sustainable yields for fishable resources
- Prescribe management options to achieve sustainable yield of fishable resources

Course Content:

1. Fish biology: External form and functional design; Locomotion; swim bladders; red muscle; Growth and estimation of growth rates, ageing techniques; reproduction & larval life
2. Fisheries assessment: Fishing techniques; Fish population dynamics, stocks, populations, recruitment, mortality; Fish populations & exploitation, fishing effort, CPUE, yield, yield models, MSY, OEY; Introduction to fisheries modeling & assessment software
3. Caribbean fisheries: Jamaica reef fisheries; Pelagics; Guyana shelf fisheries; Lobster & conch fisheries
4. World fisheries: Case study- Peruvian anchoveta collapse, El Nino, ENSO phenomenon; Lionfish invasive in Atlantic & Jamaica; Large marine mammal exploitation.
5. Fisheries management: Principles of fisheries management; Paradigm shifts in management

Practical involve:
Laboratory demonstration of fishable species showing variability and difficulties of exploitation;
Investigation of Fishable resources of Kingston Harbour demonstrating gear operation, gear selectivity, factors affecting resource distribution;
Field trips to major fish landing site tours, fisher interviews, commercial catches and gears, stage 2 issues, marketing & economic factor;
Visit to the Lionfish project at DBML, St. Ann, snorkeling on reef demonstrating invasive effects, management of invasives, lionfish behaviour and distribution studies;
Caribbean Coastal Area Management Foundation (CCAMF), Salt River, Clarendon & fish sanctuary tour to demonstrate fisheries co-management issues, ecology of sanctuaries, reality of management of a major coastal zone.

Methods of Delivery:

The course will be delivered by means of 18 interactive, multimedia presentations, with 30 hours of practicals (mainly fieldtrips) exposing students to the realities and issues related to Jamaican fisheries and the need to devise solutions to ensure their sustainable management. Six (6) tutorial discussion sessions emphasizing applying theoretical knowledge to solving problems related to sustainability of local and selected international fisheries.

Methods of Assessment:

(Students are required to pass both components):

Final Theory Examination (two hours):		60%
Coursework component:		40%
Consisting of:		
In-course test (two hours)	20%	
Reports of (4x5%) practical assignments	20%	

References:

1. **Prescribed**
   King, M., 2007. Fisheries biology, assessment and management (2nd Ed.). Blackwell Publishing. **ISBN:** 978-1405188586
2. **Highly Recommended**
   Jennings, S., Kaiser, M.J. and Reynolds, J. 2009. Marine Fisheries Ecology. Blackwell Science. **ISBN:** 978-0813801261
3. **Recommended**

Humann, P. and Deloach, N. 2002. Reef fish identification, Florida, Caribbean Bahamas. New World Publications Inc., Florida, USA, 3RD Ed. **ISBN:** 108158812621

4. **Useful Websites**

http://www.reefbase.org › Reef Fisheries Portal
http://www.oecd.org/.../0,3746,en_2649_33901_1917182_1_1_1_1,00.ht...
http://www.seafdec.org/cms/index.php?option=com_docman
http://www.springer.com › Home › Life Sciences › Animal Sciences
http://www.fao.org › FAO Home › Fisheries & Aquaculture

ZOOL3409 AQUACULTURE
(3 Credits) Semester 1 Level III

Pre-requisites: ZOOOL2401 Animal Form and ZOOL2402 Animal Physiology

Rationale:

Marine resources are in decline: overfishing and worldwide pollution are major obstacles to increased production. On the other hand, aquatic culture production of a variety of finfish, crustacean and mollusk species as well as marine plants is steadily increasing since 2000. In island states such as Jamaica with large populations, there is steadily mounting pressure for a reduction in reliance on overseas food sources. Thus there is considerable value in offering a course like this for Jamaica and the Caribbean as a supplement to sustainable fisheries production. This course also responds to the need for a graduate with grasp of the technical manipulation of aquatic ecosystems and the sustainable utilization and husbandry of the resources in them.

Course Description:

The course will cover the status of aquaculture internationally, biology of the most important scalefish, crustaceans, molluscan and plants species with potential and those currently under production, water quality, hatchery practices, culture enclosures, pond construction, nutrition, diseases, crustaceans, molluscans, plants, new technology.

Learning Outcomes:

Upon completion of this course students should be able to:

- Categorise and describe the biology of the major groups of aquaculture organisms
- Evaluate water bodies for potential for aquaculture
- Assess and evaluate hatchery and seed production facilities for aquaculture of various species
- Assess and apply nutritional requirements of culture species.
- Apply the methods of preventing and treating common diseases and maladies of culture species
- Evaluate and produce plans for modern aquaculture facilities for various culture species including molluscan species and plants.

Course Content:

1. Water quality: Dissolved gases, alkalinity and hardness, Nitrogen cycles, Phosphorus cycle, Sulphur cycles, iron cycle and Redox potential
2. Hatchery management practices: Modern hatchery systems, fish seed production, hormonal treatment, fish propagation in hatcheries, fry handling and transportation in Jamaica and other island states.
3. Pond construction: Site selection criteria, site surveying and pond design, water supply, pond management in Jamaica and other island states.
4. Fish culture, Nutrition and Diseases: Fish culture, fish production principles, stocking rates, fertilization, food chemistry, feed composition, common diseases, prophyllaxis and treatment in Jamaica and other island states.
5. Shrimp culture and Oysterculture: Marine shrimps and freshwater prawns, lobsters, oyster culture, harvesting technologies in Jamaica and other island states.

Practicals: 1. Water quality on a commercial fish farm, monitoring and evaluation 2. Hatchery on commercial fish farm, Longville Park, Clarendon, 3. Pond infrastructure and construction principles, surveying ponds, Twickenham Park Station, St. Catherine, 4. Tilapia fry production, food fish production on commercial fish farm, Barton Isle, St. Elizabeth, 5. Oysterculture technologies and harvesting methods, Bowden Bay, St. Thomas.

Methods of Delivery:

18 lectures which explain the intricacies and problems as well as potential of latest world aquaculture and mariculture techniques.
30 hours of practical (15 credit hrs.) introducing the student to the practical realities of organizing and operating small and large-scale commercial aquaculture/mariculture enterprises in Jamaica; most involving face-to-face interactions with operators and owners as well as culture technical staff.
6 tutorial discussion sessions aimed at integrating theoretical knowledge and practical exposure to gain a full understanding of world aquaculture as well as the aquaculture sector in Jamaica and other island states.

Methods of Assessment:

(Students are required to pass both components):

Final Theory Examination (two hours)		50%
Coursework:		50%
In-course test (two hours)	20%	
Practical reports (5 x 6%)	30%	

References:

1. **Prescribed**
   Lucas, J.S. and P.C. Southgate. 2012. Aquaculture - farming aquatic animals & plants (2nd Ed.), Blackwell Publishing. **ISBN-10:** 1405188588 **ISBN-13:** 978-1405188586
2. **Highly Recommended**
   Tidwell, J.H. 2012. Aquaculture Production Systems , Wiley-Blackwell **ISBN-10:** 0813801265 **ISBN-13:** 978-0813801261
3. **Recommended**
   Avault, J.W. Jr. 1996. Fundamentals of aquaculture: a step-by-step guide to commercial aquaculture. AVA Publishing Company, Inc., Louisiana, USA: ISBN- 0530113696
4. **Useful Websites**
   http://www.was.org/
   http://www.aquaculturehub.org/xn/detail/4021269:Topic:15614
   http://www.ichthica.com/

ZOOL3410 ADVANCED TOPICS IN ANIMAL SCIENCE
(3 Credits) Semester 1 Level III

Pre-requisites: ZOOL2401 Animal Form **and** ZOOL2402 Animal Physiology

Rationale:

From the general study of genetics and cell biology, to the in-depth study of organisms and systems, students who declare academic programmes in animal or human biology need to be exposed to advanced, specialized, and applied aspects of the discipline that often are not offered as formal courses elsewhere in the curricula. This course provides such opportunity for students to be exposed to topical issues in animal biology.

Course Description:

This seminar course will provide students with advanced, transferrable, specialized or applied exposure to current topics in animal and human biology through a structured series of formal presentations by local and overseas experts in the industry. It aims to equip students with in-depth awareness of the relevance of a diverse array of topical issues to the Caribbean, and with such transferable skills prepare them for the industry, or advanced studies in the field of animal or human biology.

Learning Outcomes:

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

- Synthesize and analyze current and topical issues in animal science
- Compare the wide range of approaches and techniques used by zoologists
- Inventory the zoological resources available, and access and use them
- Use rapid survey techniques for animals
- Outline the processes involved in writing an environmental impact report
- Debate the ethics and permitting of scientific investigations on animals
- Identify, generate and communicate competing arguments, perspectives or problem solving approaches

- Critically evaluate problems in animal science, their solutions and implications

Course Content:

Twelve (12) formal seminar presentations in areas such as:

1. loss of biodiversity and ecosystem balance
2. ethical treatment of animals
3. research ethics
4. animal diseases
5. rapid survey techniques
6. horizontal gene transfer
7. animal behavior
8. embryology
9. climate change; diverse perspectives
10. overpopulation
11. zoological gardens
12. professional zoology
13. paleozoology
14. permitting of investigations
15. logical framework approach
16. euthanasia
17. evolution of HIV
18. thinking critically

Methods of Delivery:

The course will be delivered by means of 12 x 2 hours interactive, multimedia presentations/discussions, with 15 hours of interactive, discussion-based tutorials based on the core material. Students will maintain a detailed Journal reflecting the main aims, content and conclusions contained in the formal presentations. In addition, students will be given three topics (not covered in the formal seminar presentations) from which to choose one to do an in-depth analysis (<2500 words).

Course Assessment:

(Students are required to pass both components)

Reflective Journal Record (10 x 5%)	50%
In-depth written Analysis (1 topic)	50%

Reference Material:

Each seminar topic will have an appropriate on-line source such as given below.

On-Line Resources:

General: www.peta.org/issues/animals-used

1. www.cbd.int/incentives/doc/biodiv-economic-value-en.pdf
2. www.applied-ethology.org/ethical_guidelines.html
3. www.ec.europa.eu/food/animal/diseases/.../csf_en.htm
4. www.jstor.org/stable/3235571
5. www.humanorigins.si.edu/resources/intro-human-evolution
6. www.biology-direct.com/content/6/1/1
7. www.animalbehavior.org/.../animal-behavior.../7AnnualABSMeetings
8. www.embryo.chronolab.com/
9. www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter9.pdf
10. www.overpopulation.org/culture.html
11. www.pretoria.co.za/events/.../216-national-zoological-gardens.html
12. www.mhprofessional.com/category/?cat=5304
13. www.mendeley.com/.../paleozoology-service-conservation-biology/
14. www.fda.gov/ICECI/EnforcementActions/.../ucm1048432.htm
15. www.intrac.org/.../The-Use-and-Abuse-of-the-Logical-Framework-Approach.pdf
16. www.billmuehlenberg.com/.../recommended-reading-on-euthanasia
17. www.ncbi.nlm.nih.gov/pmc/articles/PMC2767616/
18. www.rfidnews.org/.../18/atmel-deploys-low-frequency-rfid-for-animal-id