

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES

1.0 INTRODUCTION

The Bachelors degree in Biological Sciences at the University is a course designed to train students to acquire relevant scientific knowledge and practical skills in Biological Sciences leading to the award of the Bachelor of Science in Biological Sciences. The course employs a multidisciplinary approach from the physical and biological sciences to offer fundamental knowledge, practical and manipulative skills in biological sciences. The program is relevant to a wide range of job opportunities in diagnostic and biotechnology laboratories, research institutions, hospitals and other health institutions, food industries and health inspectorates among others.

2.0 OBJECTIVES

At the end of this program, students should be able to:

1. Demonstrate competence in different areas in the biological sciences such as botany, zoology, genetics, molecular biology etc
2. Apply the necessary knowledge and technical skills in biological science sectors and other service industries in the private, public and community sectors.
3. Invent and manage their own ventures and be involved in community development.
4. Develop skills in scientific research and writing that will enable them to work together with biological research teams
5. Establish a foundation for continuation into advanced degrees in various fields in the biological sciences.

3.0 ADMISSION REQUIREMENTS

3.1 Kenya Certificate of Secondary Education Candidates

Candidates must satisfy the minimum university entry requirements of mean grade C+.

In addition they should meet the following requirements:

1. Must satisfy the minimum entry requirements in Biology or Biological Sciences and Chemistry or Physical Sciences at K.C.S.E or equivalent examinations.
2. In addition to 3 (1) above applicants must have passes with at least C in Mathematics, Physics, Geography and English at K.C.S.E or equivalent examinations.
3. The following minimum grades should be attained by the candidates in the respective K.C.S.E subjects. Biology B- or Biological Science B, Chemistry B-, Mathematics C.

3.2 Other candidates

Admission to the degree program may be granted to the following candidates:

1. Holders of KACE with minimum of 2 principals and a credit in O-level.
2. Holders of relevant diplomas and degrees from recognized universities.

4.0 EXEMPTIONS AND CREDIT TRANSFERS.

Students may be exempted from selected courses by the University on recommendations of the School Board.

5.0 COURSE STRUCTURE AND DURATION.

The duration of the Biological Sciences degree program shall normally be extended over a period of four (4) academic years of 8 semesters. The program course should comprise lectures, laboratory practicals, field/industrial/ attachment/Teaching Practice as reflected in the course description.

The program is organized as follow:

1. All candidates must take all the core and required courses including field work, industrial attachment and research project.
2. Special exemptions may however be given where a candidate has taken equivalent courses elsewhere as may be the case with transfer students.

3. The program has a multidisciplinary nature and therefore borrows from other biological, physical and social science disciplines
4. The courses are offered in units

A unit is that part of a subject described by a coherent syllabus and taught normally over a period of a semester. It is designated as a total of 42 hours of study in a semester. For this purpose one 1-hour lecture is equivalent to one 2-hour tutorial or one 3-hour practical or any combination of this as may be approved by the Board of the School of Biological and Physical Sciences.

6.0 MODE OF PROGRAMME DELIVERY.

One semester shall comprise a minimum of 7 units and a maximum of 9 units.

The program will be delivered through lectures, practicals, tutorials and field studies.

7.0 EXAMINATIONS REGULATIONS.

University Senate Examination rules and regulations shall apply.

8.0 COURSE DISTRIBUTION

YEAR ONE SEMESTER ONE

COURSE CODE	COURSE TITLE	Contact hours		Total contact Hours	Weight (Unit)
		Lecture	Practical		
SBI 3111	Plant Structure and Function	28	14	42	1
SBI 3112	Invertebrate Zoology	28	14	42	1
SBI 3113	Introduction to Genetics	28	14	42	1
SBI 3114	HIV/AIDS	42	0	42	1
SCH 3111	Physical Chemistry	28	14	42	1
SMA 3111	Mathematics I	42	0	42	1
EEL 3115	Communication Skills I	42	0	42	1
SCS 3111	Computer Organization	28	14	42	1

	and Application				
	Total	266	70	336	8

YEAR ONE SEMESTER TWO

COURSE CODE	COURSE TITLE	Contact hours		Total contact Hours	Weight (Unit)
		Lecture	Practical		
SBI 3121	Cell Function	28	14	42	1
SBI 3122	Vertebrate Zoology	28	14	42	1
SBI 3123	Introductory Plant Systematics	28	14	42	1
SBI 3224	Non-Vascular Plants	28	14	42	1
SMA 3112	Mathematics II	42	0	42	1
SCH 3122	Organic Chemistry	28	14	42	1
SLB 3111	Development Studies	42	0	42	1
ESD 3121	Social Ethics and Integrity	42	0	42	1
	Total	266	70	336	8

YEAR TWO SEMESTER ONE

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3211	Basic Microbiology	28	14	42	1
SBI 3212	Animal Physiology I	28	14	42	1
SBI 3214	Plant Growth & Development	28	14	42	1
SBI 3215	Economic Botany	28	14	42	1
SBI 3216	Biochemistry I	28	14	42	1
SBI 3217	Fundamentals of Aquatic Ecology	28	14	42	1
SCH 3211	Inorganic chemistry	28	14	42	1

SCS 3230	Data communications and Networks	28	14	42	1
	Total	224	112	496	9

YEAR TWO SEMESTER TWO

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3221	Microbial Ecology	28	14	42	1
SBI 3222	Animal Physiology II	28	14	42	1
SBI 3223	Plant Physiology	28	14	42	1
SBI 3224	Principles of Ecology I	28	14	42	1
SBI 3225	Gymnosperm and Angiosperm Taxonomy	28	14	42	1
SBI 3226	Population Genetics	28	14	42	1
SBI 3227	Biochemistry II	28	14	42	1
SBI 3228	Field Course			160	1
SCH 3222	Analytical chemistry	28	14	42	1
	Total	224	112	496	9

YEAR THREE SEMESTER ONE

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3311	Developmental Biology	28	14	42	1
SBI 3312	Principles of Ecology II	28	14	42	1
SBI 3313	Arthropod Biology	28	14	42	1
SBI 3314	Molecular Biology	28	14	42	1
SBI 3 315	Immunology	28	14	42	1
SBI 3 316	Histology	28	14	42	1
SBI 3 317	Phycology	28	14	42	1

SBI 3318	Protozoology	28	14	42	1
BEP 3315	Entrepreneurship	42	0	42	1
	Total	266	112	378	9

YEAR THREE SEMESTER TWO

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3321	Evolutionary Biology	28	14	42	1
SBI 3322	Plant Metabolism	28	14	42	1
SBI 3323	Mycology	28	14	42	1
SBI 3324	History and Philosophy of Biology	42	0	42	1
SBI 3325	Research Methods	42	0	42	1
SBI 3326	Biostatistics 1	28	14	42	1
SBI 3327	Helminthology	28	14	42	1
SBI 3328	Entomology	28	14	42	1
	Total	252	84	816	9

YEAR THREE SEMESTER THREE

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3329	Industrial Attachment	0	0	480	
	Total	0	0	480	

YEAR FOUR SEMESTER ONE**COMMON COURSES**

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3411	Human Reproductive & Neuro-endocrine Functions	28	14	42	1
SBI 3412	Animal Behavior	28	14	42	1
SBI 3413	Plant Pathology	28	14	42	1
SBI 3414	Project I	0	42	42	1
SBI 3415	Biostatistics II	28	14	42	1
	Total	112	98	210	5

OPTIONS**Molecular Biology**

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3431	Bioinformatics and Computational Biology	28	14	42	1
SBI 3432	Gene Regulation	42	0	42	1
	Total	70	14	84	2

Microbiology

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3433	Food Microbiology	28	14	42	1
SBI 3434	Advanced Mycology	28	14	42	1
	Total	56	28	84	2

Conservation Biology

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3435	Environmental Pollution and Control	28	14	42	1
SBI 3436	Biodiversity Conservation & Utilization	28	14	42	1
	Total	56	28	84	2

Fisheries Biology

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3437	Fish and Fisheries Biology	28	14	42	1
SBI 3438	Aquatic Ecology	28	14	42	1
	Total	56	28	84	2

YEAR FOUR SEMESTER TWO

COMMON COURSES

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3421	Environmental Physiology	28	14	42	1
SBI 3422	Medicinal and Poisonous Plants	28	14	42	1
SBI 3423	Physical Methods of Analyses	28	14	42	1
SBI 3424	Economic Entomology & Pest Control	28	14	42	1
SBI 3425	Project II	0	42	42	1
	Total	112	98	210	5

OPTIONS

Molecular Biology

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3441	Basic Techniques in Genetic Engineering	28	14	42	1
SBI 3442	Microbial Genetics	28	14	42	1
	Total	56	28	84	2

Microbiology

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3443	Parasitology	28	14	42	1
SBI 3444	Environmental Microbiology	28	14	42	1
	Total	56	28	84	2

Conservation Biology

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3445	Applied Ecology	28	14	42	1
SBI 3446	Wetlands Ecology	28	14	42	1
	Total	56	28	84	2

Fisheries Biology

COURSE CODE	COURSE TITLE	Contact hours		Contact hours	Weight (Unit)
		Lecture	Practical		
SBI 3447:	Aquaculture	28	14	42	1
SBI 3428:	Limnology and Marine Biology	28	14	42	1
	Total	56	28	84	2

C: Core course, which is central to the discipline of study

R: Required course, which is supportive or beneficial to the programme

9.0 COURSE DESCRIPTION

9.1 Year ONE Semester ONE

SBI 111: Plant Structure and Functions

42 Hours

Introduction: The basic structure of cells, cell membranes, endomembrane system, chloroplast, mitochondrion, cytoskeleton and cell functions, extra cellular matrix, cell fractionation and chemical analysis. introduction to tissue systems; morphology and anatomy of angiosperm; roots, stems and leaves; primary and secondary growth of plants; structure of organs; flowers, fruits and seeds; pollination, fertilization; mechanisms of seed dispersal.

SBI 3112: Invertebrate Zoology

42 Hours

Introduction to Zoological nomenclature (ICZN). Principle of Zoological nomenclature

The course explores the invertebrates with emphasis on selected Phyla: Sarcomastigophora, Potifora, Cnidaria, Ctenophora, Platyhelminthes, Nematoda, Spinculida, Mollusca, Enchiura, Annelida, Anthropoda, Chaetognata and Echinodermata; their classification, biology, external structure, locomotion, Nutrition, excretion, Nervous system, reproduction , embryology and economic importance.

SBI 3113: Introduction to Genetics

42 Hours

Introduction to heredity ; preformation, epigenesis, pangensis, Lamarckism, Mendelism: Mendel's experimental approach, principle of segregation - monohybrid crosses, dominance, recessiveness, codominance, semidominance, lethals; Principle of independent assortment ;dihybrid ratios, trihybrid ratios; gene interaction, epistasis; sex determination and sex linkage; gene linkage and crossing over; chromosome mapping; Cytogenetics: structure and variations of the chromosomes

SBI 3114: HIV/AIDS**42 Hours**

Introduction; historical background and magnitude of HIV/AIDS, general organization of the human body, reproduction, immune system (human physiology) and other factors; sex and sexuality; the biology of the human immunodeficiency virus and viral transmission; stages of infection and the development of HIV/AIDS; opportunistic infections; HIV/AIDS prevention and infection control; peer education for HIV; treatment options and vaccine development; blood transfusion and HIV/AIDS; management of HIV and related infections; legal and Ethical Issues in HIV/AIDS; Factors that influence the spread of HIV/AIDS in Africa; case studies in selected countries in Africa; HIV/AIDS as a national disaster impacts; myths and emerging issues on HIV/AIDS.

SCH 3111: Physical Chemistry**42 Hours**

The structure and properties of matter, origin of elements, evolution of living organisms from chemical systems, bond formation and molecules. Laws of thermodynamics, Steady state kinetics, Reaction kinetics, various functional groups of organic molecules and their biological roles. Carbohydrates ;Structure and properties of mono-, di- and polysaccharides.

SMA 3111: Mathematics I**42 Hours**

Elementary set theory. Mappings and functions: Definitions, domains, codomains, range and inverses and composition of functions. Trigonometry: Functions, their graphs, inverses, degree and radian measure, sine and cosine formulae, trigonometric identities and equations. Algebra: Quadratic equations. Surds, logarithms and indices. Series: Arithmetic and geometric progressions, Permutation and combinations. Binomial theorem and applications such as approximations, simple and compound interest. Remainder theorem applications to solutions of factorials polynomials. Statistics: Collection and representation of data. Measures of central tendencies and variability. Graphical and axiomatic approaches to probabilities. Tree diagrams. Probability: Definition, axioms, tree diagram.

EEL 3113: Communication Skills**42 Hours**

Study skills; planning study time, making references, filing notes; preparing for examinations. Library Skills: organization; classification, shelving; using reference books, listening in lectures,

speeches and instructions, understanding lectures, note taking, speaking skills, asking and answering questions in lectures and seminars, making and defending arguments, agreeing and disagreeing, explaining points clearly, academic reading skills, skimming and scanning, understanding footnotes and bibliographical references.

SCS 3111: Computer Organization and Application

42 Hours

Organization: Introduction to the computer and the notion of a programmable machine. The basic organization based on the von Neumann model. Functional components (CPU, memory, I/O) and their logical organization. Number systems and internal data representation. Concept software and types of software. Components of contemporary personal computer systems from end-user perspective

Application: Classical and contemporary applications of computers. Proficiency in basic computer usage and productivity/office automation applications including word-processing, spreadsheets, e-mail, web, etc. Basic first level security and maintenance issues. Ethical and societal issues.

Year ONE Semester TWO

SBI 3121: Cell Function

42 Hours

Biological transport processes (Diffusion, Osmosis, Active Transport etc.). Classes of enzymes. The role of enzymes in cells, Basic enzyme kinetics and initial rates based on Michaelis-Menten approach. Graphical plots of kinetic data: Lineweaver-Burk, Eadie Hofstee, Cornish-Bowden. Factors effecting enzyme activity, pH, temperature, inhibitors and activators. Cell nutrition; role of carbohydrates, proteins and lipids in cell nutrition. Cellular respiration. Metabolic processes – carbohydrate metabolism, energy conservation, fatty acid metabolism, protein metabolism, and nucleic acid metabolism.

SBI 3122: Vertebrate Zoology

42 Hours

A survey of the main groups of vertebrates and their protochordate relatives emphasizing structural features, functional anatomy and evolutionary relationships. The protochordates; Urochordata and Cephalochordate. Chordate characteristics. Branchiostoma, a generalized chordate. The hermiichordata as non-chordate relatives of the chordates. Origin of the chordates.

The agnatha general characteristics; cranium and vertebral column. Fishes: chondrichythes: general characteristics; appearance of jaws; osteichthytes: actinopterygii: main groupings; body skeleton; the swim bladder.

Fish locomotion. The sarcopterygii: general characteristics; partial adaptation of life on land. reptilia: general characteristics; full terrestrial adaptations and locomotion. The cleidoic egg. Adaptive radiation. Extinction of the dinosaurs. Aves; general characteristics; homeothermy; adaptations for flight. Origin of birds. mammalia: general characteristics; origin of mammals; main mammalian groups. The primates.

SBI 3123: Introductory Plant Systematics

42 Hours

Definitions and perspective goals of taxonomy, contributions of systematic to biology. History of taxonomy, Functions and principles of classification, interrelationships of various species, herbarium techniques systematic of families of importance in ecology and biological science

SBI 3224: Non-Vascular Plants

42 Hours

General features, classification, structure, reproduction and life cycles of Thallophytes and bryophytes. Evolution, Economic importance, Distribution and Ecology of Thallophytes and Bryophytes and their diverse environmental impacts.

SMA 3112: Mathematics II

42 Hours

Coordinate geometry and equations of straight lines. Matrices: definitions, matrix algebra, determinants, transpose, adjoints, inverses and solutions of systems of linear equations using matrix method. Limit continuity. Differentiation and integration of algebraic, trigonometric, exponential functions. Applications of differentiation and integration to rates of change, maxima, minima. Area under curve. 1st order D.E and their application.

SCH 3112: Organic Chemistry

42 Hours

Introduction to amino acids: Proteins- primary, secondary, tertiary and quaternary structures. Protein denaturation, introduction to lipids, neutral lipids, polar lipids. Fatty acids: structure, properties and nomenclature. Steroids and terpenes. Chemistry of bacterial and plant cell walls.

SLB 3111: Development Studies**42 Hours**

Development studies as an autonomous discipline; the concept of development; an overview of the theories and paradigms of development; the relationship between economic growth and development; science and technology in development; developed and developing countries; issues in development: Social, economic and political; actors in development: The state, national and international NGO's, bilateral and multilateral institutions, multinational corporations (MNC's) and social movements.

ESD 3121: Social Ethics and Integrity**42 Hours**

Definitions and concepts; categories of ethics; national cohesion; integrity; unity; structural injustices; ethnicity: positive ethnicity, negative ethnicity; peace: peace making, peace building, peace transformation; stake holders in national cohesion.

9.2 Year TWO Semester ONE**SBI 3211: Basic Microbiology****42 Hours**

Introduction to the science of microbiology; brief descriptions of nature and types of micro-organisms ;prokaryotic and eukaryotic micro-organisms, introduction to bacteria, fungi, protozoa and viruses. Isolation, culture, staining microscopic examination techniques Sterilization methods, identification and classification of selected microbial groups e.g. bacteria and fungi. Microbial growth and nutrition. The effects of environmental factors on microbial growth and survival. Ecological relationships of microorganisms. The structure and replication of bacteriophage. Control of micro-organisms and chemotherapeutic agents.

SBI 3212: Animal Physiology I**42 Hours**

The structure in relation to the physiology of important biological functions and processes within the mammalian body: cells and tissues in mammals; relations of tissue structure to function; muscular and skeletal systems; heat balance and regulation of body temperature; circulatory; respiratory and digestive systems.

SBI 3213: Plant Growth & Development**42 Hours**

Types of seeds and their structure, seed longevity, seed dormancy, seed germination and quiescence. Phytochrome. Definitions of growth, growth kinetics, cellular differentiation, morphogenesis, development and Phyllotaxis. Regulation of growth and development by plant hormones. Tissue culture, apical dominance, abscission and root initiation. Hormone herbicides and other herbicides. Fruit formation, parthenocarpy. Some factors affecting growth and development: soil, light and gravity.

SBI 3214: Economic Botany

42 Hours

Plants useful to man, introduction to the major exotic and indigenous crops plants, reproduction, angiosperms, origin of major crop plants in Kenya, potential of plant Kingdom for new economic species, weed and their control. Introduction to the biology of fungi, bacteria and viruses in relation to plant pathology.

SBI 3215: Biochemistry 1

42 Hours

The structure of amino acids and polypeptides, sugars and polysaccharides, simple and compound lipids, nucleotides and nucleic acids. Basic metabolism (Carbohydrates metabolism, glycolysis, TCA cycle & photosynthesis. Lipid metabolism. Fatty acids metabolism, lipogenesis, triglyceride and phospholipids synthesis.)

SBI 3216: Fundamentals of Aquatic Ecology**42 Hours**

Water distribution, the hydrological cycle, mineral transport, physical and chemical characteristics of water of biological importance. Water as a habitat, primary production, phytoplanktons and macrophytes. Estimation methods. Nutrient cycles. Redox and thermal stratification. Illumination. Temperature. Turbulence. Secondary production; grazer and reducer pathways. Exploitation, conservation and restoration of aquatic environment resources. Physiological adaptations of life in water.

SCH 3211 Inorganic chemistry:**42 Hours**

Electron configuration of atoms, quantum – numbers, orbitals shapes, atomic structure and atomic spectra of hydrogen and hydrogen-like atoms, periodic table, covalent and ionic bonding, introduction to types of inorganic solids, symmetry and shapes of simple molecules, molecular orbitals.

SCS 3230: Data-Communications and Networks**42 Hours**

Introduction to data communication; Data transmission system components; Modulation and modulation methods; Transmission media and their characteristics; Communications interfacing standards; Bandwidth, data rates, capacity; Data communications equipment; Data encoding; Synchronization; Error control: detection and correction; Data compression; Multiplexing; Layered Protocol Architecture; International Standards Organization/Open Systems Interconnection(ISO/OSI) reference model, Medium access protocols; Network topologies

Computer Networks. Classification: Local Area Networks (LANs), Metropolitan Area Networks (MANs), Wide Area Networks (WANs); Switching technology: circuit switching, packet switching; Routing and bridging; Internetworking, Transmission Control Protocol/Internet Protocol (TCP/IP), addresses, data units, address resolution, sub networking.

Year TWO Semester TWO

SBI 3221: Microbial Ecology

42 Hours

Nutrient acquisition, bacteria in low nutrient environments, competition and antagonism. Micro-organism and environmental changes. Methods of studying Microbial Ecology. Micro-organism in aquatic and terrestrial habitats. Biogeochemical cycling and energy flow carbon, nitrogen & phosphorus, sulfur and iron cycles. Energy source for ecosystems. Mutualistic relationships between micro-organisms and eukaryotes; mycorrhizae symbiotic nitrogen fixers in plants, micro-organisms and herbivores.

SBI 3222: Animal Physiology II

42 Hours

The structure in relation to the physiology of important biological functions and processes within the mammalian body: nutrition; metabolism; osmoregulation; excretion and integration (endocrine, sensory and neuro-physiology); associated malfunctioning of these systems.

SBI 3223: Plant Physiology

42 Hours

Water relations of plants – the ascent of sap, stress, stress physiology, plant moisture stress, plant processes sensitive to water stress, plant productivity and water stress. Free energy and chemical potential. Water potential. Role of water and auxin in cell enlargement. Mechanism of stomatal action. Absorption of mineral salts. Translocation of solutes. Physiology of flowering: the stage of ‘ripeness to flower’ and ‘earliness’, morphological stages in the transformation of a vegetative to a floral meristem. Photoperiodism and flowering. Vernalization

SBI 3224: Principles of Ecology I

42 Hours

Introduction to Ecosystems. Dynamic interrelationships of plant and animal communities with their environments. Theoretical background and methods of estimating primary and secondary production in plants and animals. Ecological energetics; populations within ecosystems. Man and his habitat. Biogeochemical cycles.

SBI 3225: Gymnosperm and Angiosperm taxonomy**42 Hours**

Significance of taxonomy and its relationship with other biochemical disciplines, history of classification, role of fossil angiosperm and gymnosperms to taxonomy, hierarchy of taxonomy characters, Inter-specific variation and isolation, nomenclature, herbarium and its relevance /role in plant taxonomy survey of selected families from the flora of East Africa

SBI 3226: Population Genetics**42 Hours**

Populations and gene pools: Genetic structure of populations; gene frequencies, estimation of gene frequencies: Hardy-Weinberg law; testing of the equilibrium, extension of Hardy-Weinberg law to more than two alleles; calculation of heterozygote frequencies in a population: Factors affecting the genetic structure of populations; natural selection: mutations; migration; genetic drift: Non random mating; inbreeding gene fixation in natural communities, coefficient of inbreeding; heterosis: Introduction to ecological genetics: Introduction to quantitative genetics.

SBI 3227: Biochemistry II**42 Hours**

The structure and conformation of proteins enzymes and their classification. The physiological control of enzyme activity. Zymogens, haemoglobin, insulin, ribonuclease. Membrane functions, composition and properties of membrane, proteins and phospholipids. Vitamins, clinical aspects of nutrition, chemical neurotransmission system. Diabetes and other hormonal disorders.

SBI 3228: Field Work:**42 Hours**

This course will expose students to zoological, botanical and microbial organisms as they actually occur in their environment. Parameters to be taken into consideration will be methods of sampling, population densities, identification and classification, trophic relationships, adaptation to the environment. Onsite consideration of diseases parasites, vectors and crop pests, will be demonstrated in research laboratories, quarantines and in the field. Wildlife management practice and museum techniques will be studied together with observable features that adapt animals and plants physiologically to their environment.

This is a proposed field study for all students to undertake at the end of the second year. It is a core requirement for continuation into the third year. All students must undertake and pass this

course to be able to move to the third year. This course will take the students to the field for a period that will be determined by the faculty from time to time depending on the capability of the faculty in terms of human and financial resources.

SCH 3222: Analytical Chemistry

42 Hours

Basic electrical measurements, introduction to semi-conductors and associate circuits and superconductivity. Instrumental methods of analysis: theory and instruction of Ultraviolet/Visible absorption , Flame Emission, Atomic absorption, TOMIC Fluorescence, Nuclear Magnetic Resonance, Mass – and Electron Spin Resonance spectroscopy.

9.3 Year THREE Semester ONE

SBI 3311: Developmental Biology.

42 Hours

Description and causal analysis of the main events in the development of representative invertebrate and vertebrate animals: Segregation of the germ plasma and primordial germ cells, gametogenesis, fertilization, cleavage, gastrulation and organogenesis. Structure and function of extra embryonic membranes in the development of the chick. structure, function and maintenance of the placenta; types of placentae; cellular differentiation by cytoplasmic segregation and intercellular interactions. Primary and secondary embryonic inductions. Sex differentiation and determination. Cell migration and cell adhesions. Pattern formation as illustrated by the vertebrate limb.

SBI 3312: Principles of Ecology II

42 Hours

Plant community development, history of origin and evolution of the community. Community organisation: structure and composition, destructive and non-destructive measures for studying plant and animal communities. Major types of biomes: tundra, taiga, chaparral, deciduous forest, grassland and tropical forest. Ecological survey of the East African vegetation types; wetlands, savannahs, Sahel and humid tropical forest; their distribution and the status of their exploitation. Application of ecological concepts to management of animal populations. Human population ecology.

SBI 3313: Arthropod Biology

42 Hours

Introduction to Phylum Arthropoda. General classification of Arthropoda. Anatomy and physiology of arthropods. Arthropod growth and development; theory of sexual selection, the diversity of behaviour and morphology associated with sperm transfer in the arthropods and their ecdysozoan relatives. Arthropod ecology and behaviour

SBI 3314: Molecular Biology

42 Hours

An introduction to genetic notations, conventions and terminology. Prokaryotic chromosomal DNA: structure and function, Plasmid DNA structure, functions, host range, compatibility and copy number regulations. Phage DNA structure, infection, replication and function. Classes of RNA: synthesis, structure, function, phylogenetic significance, mutagenesis, mutations and mutant types, notations, biochemical basis of mutants. Mutagens: spontaneous base analogue, chemical mutagen, intercalating agents, mutator genes, spontaneous types of mutations; inversion, translocation, missence, nonsense, frameshift, deletion, insertion etc. Reversion and revertants. Transgenics: conjugation, transformation and transduction.

SBI 3315: Immunology

42 Hours

Introduction to the immune response: Different types of immunity. Cells and tissues of the immune system. Antibodies: Generation of antibody diversity: Immunoglobins gene structure and rearrangement. Antibody structure and function. Measurement and Production of antibodies in vitro, monoclonal antibodies. Uses of antibodies in modern research. Immune response: Production of antibodies in vivo: B-cells. Killing mechanisms I:- The complement system. Recognition of Target: The Major Histocompatibility Complex. Killing mechanisms II:- T-cells and the T-cell receptor. How the system deals with immune challenges eg. bacteria, viruses and parasites. Failure of the immune response: Immunodeficiencies and autoimmunity. Transplantation and HIV.

SBI 3316: Histology

42 Hours

Method of histological study; preparation of tissues and use of microtomes, fixation and staining Microscopic techniques including electron microscopy; cryofracture and radioautography; cell fractionation and differential centrifugation and cellular components; Histochemistry and cytochemistry including fluorescence and immunology techniques; Interpretation of tissue

sections; Tissues; epithelial, connective, adipose, bone, cartilage, muscle, skin and haemopoetic, circulatory, lymphoid, digestive, respiratory, urinary, nervous, sensory, endocrine and reproductive system organs and glands and their tissues structures.

SBI 3317: Phycology

42 Hours

Fine structure and classification of the algae. Range of morphological forms and methods of reproduction and life cycles in major classes. Evolutionary trends. Habitat range marine, fresh water and terrestrial, algal physiology, pigments, light absorption and photosynthesis, respiration and desiccation. Natural products, their extraction and commercial value.

SBI 3318: Protozoology

42 Hours

Basic concepts of parasitology: adaptations to parasitic mode of life; host-parasite relationships. The morphology, life cycles, physiology, biochemistry, medical and economic importance of protozoan parasites. Epidemiology, diagnosis, treatment and control of protozoan infections. Immunology of protozoan infections.

BEP 3315: Entrepreneurship

42 Hours

Definition of Small and Medium Enterprise (SME); Theory and philosophy of entrepreneurship; Production efficiency, factor resource intensity, large vs. small enterprises, and justification for small enterprises; Understanding entrepreneurship: Starting a SME, creating and managing the venture; Sources of capital in venture creation; Consumer-entrepreneur relationship: role of product quality, innovation and skill in product quality; Marketing of SME product; Competitiveness; Scaling up; institutional arrangements; standards and quality; Barriers to SME development; role of SME in economic development; Case studies of successful SME: Indicators, vertical integration.

Year THREE Semester TWO

SBI 3321: Evolutionary Biology.

2 Hours

Basic principles; history of evolutionary ideas; evidence of organic evolution. Theory of evolution by natural selection; evidence for natural selection. Other mechanisms of evolutionary

change. Patterns of evolution. Social implications: importance of genetic diversity in human, other animal and plant populations.

SBI 3322: Plant Metabolism

42 Hours

Photosynthesis: discovery, evidence that photosynthesis is a several stage process, source of oxygen produced and the light and dark reactions. Respiration. Nitrogen metabolism: forms of nitrogen available to plants, nitrate reduction, relationship of nitrate reduction to respiration and photosynthesis, assimilation of ammonium into organic compounds, protein synthesis and nitrogen cycle. Mineral nutrition: water culture experiments, roles of mineral nutrients in plant metabolism and symptoms of mineral deficiency.

SBI 3323: Mycology

42 Hours

The general characteristics of fungi – general physiology, somatic structures, sexual and asexual reproduction and classification. Systematic treatment of major groups with accounts of morphology, life cycle, nuclear cycle and life habitats. Sexuality, parasexuality and heterokaryosis in fungi. Ecology of fungi. Mycorrhiza. Fungi as saprophytes, symbionts and parasites. Importance of fungi to man.

SBI 3324: History and Philosophy of Biology.

42 Hours

History: the growth of biological thought from the ancient Greeks to the present day. Re-transmission to the West and the rise of Western science in the 12th and 13th centuries. The classical microscopists. The early taxonomists to Linnaeus. The overthrow of spontaneous generation theory: Redi, Spallanzani and Pasteur; modern ideas of the origin of life. Organic evolution: Buffon, Larmack to Darwin and Wallace; modern controversies. Mendel and modern genetics. The new synthesis. Watson and Crick and molecular biology. Philosophy: the presuppositions of science. The nature of scientific law and the meaning of scientific explanation. The hypothetico-deductive method. Scientific proof: verificationism and falsificationism. Reductionism in science. The unity and diversity of scientific methods. Role of concepts and their refinement in biological explanation. Science and Religion. Topical issues in science ,technology and medicine today: Gene technology in crop production and medicine.

SBI 3325: Research Methods.**42 Hours**

Philosophical aspect of scientific research and innovation and the methods and nature of science, including their application in biological science; preliminary review of state of scientific knowledge and literature survey of sample topics in biological science; different types of biological studies: Cross-sectional, vertical or prospective and follow up, retrospective cohort, time-series, case-report, case-series, case-control, controlled exposure, monitoring and surveillance. Research proposal formulation including generation of hypotheses, study objectives and laying out research plans and questionnaires; Resources required: personnel, budgeting and seeking for research funds support and collaboration; units of measurements and scientific calculation used in biomedical research and practice. Data analysis, interpretation, reporting, publication and references. Seminar presentation and analysis.

SBI 3326: Biostatistics I**42 Hours**

Introduction to Basic concepts; notation, tables and charts and organisation of data. Measures of location: Mean Median, Mode and Percentile for grouped and ungrouped data and Graphical estimation. Measures of dispersion: ranges, mean, deviation, variance and standard deviation skew ness and kurtosis. Probability; probability distributions, random variables and the normal distribution.

SBI 3327: Helminthology**42 Hours**

The morphology, life cycles, physiology, biochemistry and medical/economic importance of helminth parasites infections. Epidemiology, diagnosis, treatment and control of helminthic infections. Immunology of helminthic infections.

SBI 3328: Entomology**42 Hours**

Introduction to insects: characteristics and identification, success and abundance, economic importance in relation to man. The biology and ecology of insects. Characteristic features and economic importance of the following orders of insects: Thysanura, Collembola, Orthoptera, Isoptera, Zoraptera, Ephemesoptera, Odonata, Plecoptera, Psocoptera, Mallophaga, Embioptera, Thysanoptera, Anoplura, Hemiptera, Homoptera, Desmaptera, Neusoptera, Coleoptera, Strepsiptera, Mecoptera, Trichoptera, Lepidoptera, Diptera, Siphonaptera and Hymenoptera. Principles of control of insects: Physical, chemical and biological

SBI 3329: Industrial Attachment**480 Hours**

Students will be attached to biological science based research institutions for a period of 12-14 weeks (between the end of year 3 and beginning of year 4) in line with their chosen options for year 4; during the industrial attachment students will be expected to acquire first hand impressions and experience of practical activities through personal participation and involvement; academic member/s of staff will visit each student at their place of attachment at least twice for on-the-spot evaluation; each student will submit their report within the first 30 days of the 4th year semester one.

9.4 Year FOUR Semester ONE**COMMON COURSES TAKEN BY ALL STUDENTS IN THE FOUR OPTIONS****SBI 3411: Human Reproductive & Neuro-endocrine Functions****42 Hours**

The brain, spinal chord; parts of the brain and their functions; blood-brain barrier. Cerebral circulation and the factors affecting; cerebral circulation, cerebrospinal fluid, peripheral nervous system, sensory receptors, sensory coding, spinal reflexes, somatosensory system, sensory pathways, pain and motor-pathways. Reproduction; the male reproductive system,

spermatogenesis, sperm maturation, storage and capacitation, endocrine function of testis and abnormalities of testicular function. Female reproductive system; oogenesis, menstrual cycle, ovarian and uterine cycles, control of menstrual cycle, disorders of menstrual cycle, ovarian hormones, puberty, climacteric/menopause, human sexual response, pregnancy, fertilisation and implantation, placental functions, hormonal changes during pregnancy and parturition. Disorders in fertility.

SBI 3412: Animal Behaviour

42 Hours

Definition. Methods and Problems: the ethological approach – characteristics, strengths and weaknesses; Brief outline of the classical ethological theory; Modern study of behaviour. Behavioral specializations: Sensory capacities and limitations; Motor specialisations – levels of structure and behaviour. Behavioral inventories: Self maintenance – securing food, defense, etc; Species maintenance or reproductive behaviour, mating, parental care. Social Behaviour: Aggregations, Communication. Organisation of behaviour: Stimulus response mechanisms. Discrimination; Oriented movements – taxis. Motivation – Spontaneous behaviour, Drive. Ontogeny of behaviour: Instinct/inherited behaviour; Learning behaviour; Intelligence; Consciousness. Rhythms of behaviour – adaptive significance. Applied ethology.

SBI 3413: Plant Pathology

42 Hours

Types of plant diseases. Study of important diseases of crops in East Africa. Morphology and germination of fungal spores. Spore liberation, dispersal and deposition in pathogenic fungi. Host-parasite interaction. Morphology and nature of virus particles. The main groups of plant pathogenic viruses. Infection of plants by viruses. Mycoplasmas. The main groups of plant pathogenic bacteria. Morphology of plant nematodes. The main groups of plant pathogenic nematodes. Ecology of plant pathogenic nematodes. Soil-borne disease. Survival and infection of plants by soil inhabiting pathogens. Epidemiology and controls of plant diseases of importance in Ghana. Formae speciales and physiological races. The gene-for-gene concept. Breeding for resistant cultivars.

SBI 3414: Project I

42 Hours

Project will be captured in a thesis that will be a detailed written report on a research carried out independently by individual students over a period of two semesters. Project titles are selected with reference to the research interest and capabilities of staff. Main objectives – use of literature, learning of research techniques, an appreciation of the nature of biological problems and their solution - devising appropriate experiments and/or planning sets of interventions, requiring careful observation, data collection, analysis, discussion and drawing of appropriate conclusions. Projects should preferably be professionally relevant and demand-driven to enhance individual employment prospects. This first aspect will dwell on the objectives of the proposed project, literature review and materials and methods.

SBI 3415: Biostatistics II

42 Hours

Central ideas of estimation, confidence intervals and hypothesis tests. To perform sensible statistical analyses using the computer package SPSS and to report the results of analysis effectively. Large sample estimation; large sample tests of hypothesis; small sample tests. Hypothesis tests (including test of association for tables). Experimental design and Analysis of Variance. Regression and Correlation. Multiple regression. Discrete distributions. Tackling non-standard problems (including data transformations). Overview and tips on writing statistical analyses.

ELECTIVE COURSES: STUDENTS TO TAKE ALL COURSES IN THEIR OPTION

OPTION 1: MOLECULAR BIOLOGY

SBI 3431: Bioinformatics and Computational Biology

42 Hours

The basics of computational biology and bioinformatics including intelligent systems, cybernetics and their applications in biomedicine; Resources, sequence databases and information retrieval systems; Windowed analysis, statistics and dot matrix plot; Homology and introduction to alignments and data searches including evaluation of scoring systems: FASTA, BLAST, etc, Probability models and Bayes theorem; Genetic algorithms and evolutionary computing; Gene modeling, resources and ontologies; Computer based modeling systems for macromolecular analysis and crystallography; Phylogenetics, multiple alignments

and trees; Gene and protein families, and motifs; Gene and protein structural properties, homologies, and use of computational biology and bioinformatics in functional genomics and proteomics.

SBI 3432: Gene Regulation

42 Hours

Prokaryotic gene regulation: Transcriptional control; promoters, terminators, attenuators and anti-Terminators, induction and repression, attenuation, signal transduction, global regulatory systems, feast or famine and the Rpos Regulon, quorum sensing

Translational control; ribosome binding, codon usage, stringent response, regulatory RNA

Eukaryotic gene regulation: Levels of regulation; transcription, RNA processing, mRNA lifetime (longevity), and translation. Regulatory elements of eukaryotic genes; promoters, transcription factors and enhancers. Tissue specific gene regulation, specialised transcription factors.

OPTION 2: MICROBIOLOGY

SBI 3433: Food Microbiology

42 Hours

The scope of Food Microbiology – Food spoilage, Preservation, Food safety, Fermentation, Microbiological Quality Assurance. Microorganisms and Food Materials – Diversity of habitat – Air, Soil, Water, Plants and Animals. The Microbiology of Food Preservation – Canning, Pasteurization, Irradiation, Freezing, Packaging, Chemical preservatives. Spoilage (decay and disease). Food Microbiology and public Health. Bacterial and Non-bacterial agents of food-borne illness. Microbes as food – mushrooms, algae, single cell protein (bacteria, yeasts). Microbes in food production – cheese, yoghurt, bread, beer, wine, vinegar, soy sauce and Methods for the microbiological examination of foods. Controlling the microbiological quality of foods.

SBI 3434: Advanced Mycology**42 Hours**

Taxonomy; the taxonomic concept; the taxonomic criteria. Spore form and function. Ontogeny of spores. Influence of environment on spore formation. Nutrition. Physiology of parasitism and infection. Fungal cultures ; roles of culture collection, instability in cultures, strain degeneration and culture collections. Methods of culture maintenance. Sexual reproduction systems in monoecious and dioecious forms. Alternatives to sexual reproduction. Vegetative incompatibility. Evolution fungal ecology. Distribution; terrestrial, freshwater, saprobic marine fungi, thermophiles, psychrophiles, symbiotic fungi and their associates. Domesticated fungi – mushroom growing, industrial fermentations. Host- pathogen interactions. Control of parasitic fungi. Lichens: forms of cell structure, types of thallus, nature of association between alga and fungus, physiology of symbionts, parasitism of algae on lichens, lichen physiology, ecology; economic aspects.

OPTION 3: CONSERVATION BIOLOGY**SBI 3435: Environmental Pollution and Control****42 Hours**

Environmental degradation process leading to eutrophication and pollution; origin of nutrients under natural and artificial conditions; effects of watershed manipulation on nutrient loading; nitrogen and phosphorus flux across sediments and water interfaces; urban pollution and industrial waste; freshwater and marine pollution; pesticides and biological magnification; sewage and self purification of streams; case histories of river pollution and recovery; biological indicators of eutrophication and pollution; environmental impact assessment ;management of natural and artificial water bodies.

SBI 3436: Biodiversity Conservation & Utilization**42 Hours**

Definitions and current status. Biodiversity and a gene pool. Preservation value of biodiversity. Human dependence on biodiversity. Domesticated biota: indigenous and exotic. Introduction to some basic concepts of biological diversity, how it is organised in the natural world, what threatens it and what the costs and benefits of sustaining ecosystems might be. Renewable and non-renewable resources of the earth; conservation and development aims. Human activities and loss of biodiversity with special reference to tropical ecosystems and East African communities. Conservation principles and strategies; case studies of the environmental and social

consequences of economic development and conservation in tropical climate. Tourism. Principles and techniques of beekeeping and mushroom and butterfly rearing.

OPTION 4: FISHERIES BIOLOGY

SBI 3437: Fish & Fisheries Biology

42 Hours

Classification, morphology and functional anatomy of fishes. Distribution and ecology of selected groups of tropical African fishes. Dynamics of fish populations Assessment of fish production. Growth measurement. Exploitation of fishery resources. Management of natural and cultured fishes stocks. Introduction to fish disease and fish toxicology. Aquaculture.

SBI 3438: Aquatic Ecology

42 Hours

The freshwater environment-physical, chemical and biological characteristics of standing and running waters. Methods of determining physico-chemical factors in the freshwater environments: temperature, density, dissolved oxygen, Biochemical oxygen demand, free carbon dioxide, pH, total dissolved solids, total solids, colour, turbidity, transparency, salinity, nitrates, ammonia, phosphates and hydrogen sulphide. Freshwater plants and animals-distribution and adaptations. Community structure and dynamics in lakes and rivers. Productivity of lakes, nutrient cycling and eutrophication.

YEAR FOUR SEMESTER TWO

COMMON COURSES TAKEN BY ALL STUDENTS IN THE FOUR OPTIONS

SBI 3421: Environmental Physiology

42 Hours

Principles of homeostasis. Serve-mechanisms of organisms. Adaptation-definitions, adaptations to special environments , desert region, cold region, high altitude, and aquatic environment. Hibernation, aestivation, diapauses. Respiration, osmo-regulation and excretion. Buoyancy and Diving and Biological rhythms.

SBI 3422: Medicinal and poisonous plants

2 Hours

Broad classification and identification of both medicinal and injurious plants to human and his livestock, with special reference to Kenya, Photochemistry of drugs plants, propagation of drugs

plants, traditional methods of preparation and application of herbs remains, basic symptoms of injuries caused by common poisonous plants

SBI 3423: Physical Methods of Analyses

42 Hours

Optical based spectral methods: Generalities, Principles and applications of spectroscopic analyses (Atomic, NMR, UV, Infrared, Raman, electronic, turbidometry and nephelometry, fluorescence, phosphorescence). Laser technology and applications

Optical based non spectral methods; Generalities and principles of reflectometry, Polarimetry, Rotatory dispersion and Circular dichroism.

Mass spectrometry, Chromatographic types (adsorption, ion exchange, affinity, size exclusion, phase based e.g liquid-liquid) Electrophoretic methods

Sedimentation techniques; theory, forces involved and types of sedimentation techniques. Applications of sedimentation. Electrophoresis - theory and equipment used. Applications of electrophoresis. Electrical phenomena and electro-chemistry.

SBI 3424: Economic Entomology & Pest Control

42 Hours

Life cycles of selected insects of economic and medical importance. Insect vectors of human diseases – Simulium damnosum, Mosquitoes (Anopheles sp., Aedes sp. and Culex sp.), Glossina sp. Human diseases such as Malaria, Filariasis, Yellow fever, Onchocerciasis, Trypanosomiasis, Dengue fever. Mode of transmission, symptoms and treatment. Control of the vectors must be emphasised. Numerical change in insect populations. Theories to explain insect numbers. Life system concept. Ecological basis for pest control. Methods of pest control and the concept of integrated pest management (IPM). This should be discussed with respect to insect pests of agricultural importance.

SBI 3425: Project II

42 Hours

Project will be captured in a thesis that will be a detailed written report on a research carried out independently by individual students over a period of two semesters. Project titles are selected with reference to the research interest and capabilities of staff. Main objectives – use of literature, learning of research techniques, an appreciation of the nature of biological problems and their solution - devising appropriate experiments and/or planning sets of interventions,

requiring careful observation, data collection, analysis, discussion and drawing of appropriate conclusions. Projects should preferably be professionally relevant and demand-driven to enhance individual employment prospects.

ELECTIVE COURSES: STUDENTS TO TAKE ALL COURSES IN THEIR OPTION

OPTION 1: MOLECULAR BIOLOGY

SBI 3441: Basic Techniques in Genetic Engineering

42 Hours

Cutting and joining DNA – restriction enzymes, recognition sequences, DNA ligases; plasmids, expression vectors; cloning; selection of recombinants and systems of gene expression; agarose gel electrophoresis; nucleic acid blotting - Southern blotting, northern blotting, western blotting; transformation of *E. coli*; PCR- basic reaction, RT-PCR, key factors affecting PCR; fundamentals of gene sequencing.

SBI 3442: Microbial Genetics

42 Hours

Organization of bacterial, fungal and viral genomes, mutagenesis; genetic recombinations; control of gene expression in bacteria. Basic biology of plasmid and phage vectors; cosmids, phasmids and other special vectors. Bacteriophage genetics; single stranded DNA phages, double stranded DNA phages, RNA phages. Bacteriophage T4, bacteriophage lambda; control of lysogenic and lytic cycles. Yeast genetics: *S. cerevisiae* life cycle, sex determination, tetrad analysis, yeast transposons. Cloning strategies in *E. coli*, cloning in bacteria other than *E. coli*, cloning in yeast.

OPTION 2: MICROBIOLOGY

SBI 3443: Parasitology

42 Hours

Ecological and epidemiological concepts: symbiosis, mutualism, commensalisms and parasitism (endo-, ecto-, obligate, facultative, accidental, temporary, hyper). Evolution of parasitism. Morphology and life cycle of some phyla: Protozoa – Amoeba (*Entamoeba histolytica*), Flagellates (*Giardia*, *Trypanosoma*), Sporozoa (*Coccidia*, *Plasmodium*, *Eimeria*, *Toxoplasma*), Platyhelminthes and Aschelminthes: Trematodes (*Fasciola*, *Schistosoma*), Cestoda (*Taenia*, *Echinococcus*), Aschelminthes/Nematodes (intestinal, blood and tissues types). Arthropods: Arachnids (ticks, mites), Insects (lice, fleas, bugs, flies, myiasis, parasitic hymenoptera), Crustaceans (copepods). Epidemiology, diagnosis, pathogenesis, immunology, treatment and control of the diseases caused by the parasites mentioned above.

SBI 3444: Environmental Microbiology

42 Hours

Microbiology of sewage treatment, reduction of biological oxygen demand, municipal sewage treatment methods, individual sewage treatment systems; rural dwellings, Drinking water treatment and testing; water treatment processes and water testing. Microbiology of solid waste treatment, land fills, commercial and backyard composting. Microbiology of bio-remediation; pollutants, synthetic compounds and pesticides. Microbiology of extreme environments; hot springs and soda lakes of the Rift Valley.

OPTION 3: CONSERVATION BIOLOGY

SBI 3445: Applied Ecology.

42 Hours

Application of ecological concepts to the following topics: management of animal populations; agricultural ecosystems: the effects of disturbance on ecosystems including pollution and desert formation; classification and management of communities for rational land use and conservation: human population ecology.

SBI 3446: Wetland Ecology.

42 Hours

Distribution and diversity of wetland communities; morphology and chemistry of wetland soils; hydrology of wetlands; micro-meteorological characteristics of wetlands; adaptations of wetland plants; biomass and primary production in wetlands; decomposition and mineral cycling in

wetlands; nitrogen fixation and de-nitrification processes; wetlands as nutrient filters and sewage treatment facilities; problems of aquatic weeds and their control; the conservation and management of wetlands.

OPTION 4: FISHERIES BIOLOGY

SBI 3447: Aquaculture

42 Hours

Pattern of reproduction of fish suitable for culture. Inducement of spawning in fish. Growth of fish under culture. Fish rearing. Pond management. Diseases of fish. Growth and maintenance of fish populations. Food, competition and niche. Predator-prey relationships. Fish populations dynamics. Fishing gear. Techniques in location of fish stocks. Fisheries management. Forecasting. Fish processing

SBI 3448: Limnology and Marine Biology

42 Hours

Origin and distribution of lake basins; morphology and morphometry of lakes; Physical and chemical properties of water, thermal and optical properties of lakes and rivers: hydrological cycle and water balance of lakes, salinity and oxygen content of inland waters; carbon, nitrogen, phosphorous and sulfur cycles in lakes: phytoplankton communities; littoral zone communities, primary production, Lindeman's trophic-dynamic aspects of energy flow, ontogeny and evolution of lake ecosystems; palaeolimnology; the Nile and Yala rivers as case studies of running water; Lake Victoria and Naivasha as case studies of standing water; water management problems: water supply, recreation. Sewage disposal and man-made lakes.