Escuela Superior Politécnica del Litoral

Department of Biology

Handbook

Facultad de
Ciencias de la Vida

2022-2023

Contents

Biology Handbook 2022-2023

Escuela Superior Politécnica del Litoral

Welcome to the students

Department of Biology

Dear students, we welcome you to the biology course. We hope that this manual is useful for all of you; studying Biology can prepare you for a wide range of specialties. If you like, science and challenges this career path is for you.

At Espol's biology department, you will have the opportunity to learn from some of the best academics in the specialty of Biology; they will guide you throughout your career not only inside classrooms, but also in field practices and inside the laboratory. It is important to mention that the biology faculty cares for each one of its students.

Mission

The mission of the biology department is to educate highly trained professionals that are able to understand living beings and their biological processes, to train professionals of excellence in the Life Sciences such as biology with cultural, ethical, social environmental principles and values. Allowing undergraduates to evaluate the desires and needs of the human being, with the ability to promote the sustainable management of the country's strategic natural resources (soil, water, air, subsoil, forests and biodiversity), and with research and management aptitudes necessary to tie together sustainability and participatory social networks through entrepreneurship and work with the community.

Vision

To be a referent in undergraduate and postgraduate training with international standards in the areas of Life Sciences and be recognized as a unit that generates solutions at the service of society and nature conservation.

Aims of the program

1. Be highly competitive in the field of biology at a national or international level, effectively applying the knowledge of the profession, considering the social, economic and environmental aspects in an ethical framework.

2. Be at the forefront of technical-scientific knowledge, and experience in the field of biology, in different cultural contexts, which allows the student to adapt in professional environments.

3. Apply classic and innovative procedures for the use, conservation, sustainable management of biodiversity and environmental health.

4. Participate in productive projects or scientific research, in the area of their competence, in order to contribute to the development of society.

Introduction

The biology department is located in the Faculty of Life Sciences of the Escuela Superior Politécnica del Litoral; it was created on July 22, 2015 by resolution CES RPC-SO-28-No.364-2015. The ESPOL Polytechnic Council (Governing Board) created the Biology Program in 2004 and throughout its existence; the program has experienced several academic reviews (2008, 2009, 2012, 2016 and 2020). From its creation, until 2015, the Biology Program took place at the Maritime Engineering, Oceanography and Sea Science Faculty (FIMCBOR). As of 2015, the Biology Program was relocated and is now part of the Faculty of Life Sciences. It has more than 30 professors. The faculty authorities work hard to help students throughout their career. This manual is designed for all those students who wish to obtain a major in biology. This handbook provides important information that will help students throughout their careers. Students will be able to become familiar with the curriculum, faculty, and extracurricular activities.

Program's Learning Outcomes

Students who successfully earn a degree from ESPOL`s Biology department will be able to:

- Apply knowledge of mathematics, science, and applied sciences in the field of biology.
- Design and perform experiments, as well as analyse and interpret biotic and abiotic data.
- Formulate or design a system, process or program to meet specific needs.
- Use scientific methods to identify and solve problems.
- Understand the impact solutions to specific problems have in a global and social context.
- Use modern scientific-technical techniques and tools necessary in their professional life.

Faculty and staff

Teacher	Investigation Area	Email
Marynes Montiel Romero	Environmental Microbiology with emphasis on transmission of pathogens through water, air, sediments, seafood and its impact on public health	marymont@espol.edu.ec
Luis Lenin Galarza Romero	Phytopathology and Microbiology	llgalarz@espol.edu.ec
Nardy del Valle Diez García	Protein-based bioproducts with the potential to transfer to industry.	ndiez@espol.edu.ec

Pablo Antonio Chong Aguirre	Molecular Biology, Phytopathology, Microbiology, and resistance to Fungicides.	pachong@espol.edu.ec
Freddy Arturo Magdama Tobar	Phytopathology	frearmag@espol.edu.ec
Ana Jesenia Tirapé Bajaña	Laboratory of Toxicological Research and Environmental Health.	atirape@espol.edu.ec
Diego Arturo Gallardo Pólit	Direction of integration projects.	dagallar@espol.edu.ec
Lisbeth del Rocío Espinoza Lozano	Entomology and plant protection	ldespino@espol.edu.ec
Milton Senen Barcos Arias	Environmental remediation.	mbarcos@espol.edu.ec
Paolo Michael Piedrahita Piedrahita	Zoology and biodiversity.	ppiedra@espol.edu.ec
Luis Eduardo Sánchez Timm	Plant biotechnology, related to the identification of resistance genes, as well as the genetic engineering of crops for the characterization of genes	lesanche@espol.edu.ec
Carlos Roberto Burbano Villavicencio	Plant Biotechnology and Molecular Genetics.	rburbanol@espol.edu.ec
Julio Andrés Bonilla Jaime	Plant and environmental biotechnology.	jabonill@espol.edu.ec
Jenny Antonia Rodríguez León	Marine biodiversity and biodiscovery applied to human and animal health.	jenrodri@espol.edu.ec
Gustavo Adolfo Dominguez Cazco	Pollution and environmental toxicology	gdoming@espol.edu.ec
Juan Manuel Cevallos	Applied Microbiology	jmceva@espol.edu.ec

Cevallos		
Julie Ruth Nieto Wigby	Invertebrate physiology.	jnietow@espol.edu.ec
Félix Enrique Morales Ramos	Aquatic ecology and oceanography.	femorale@espol.edu.ec
Efrén German Santos Ordoñez	Biotechnology, Molecular Biology and Genetic Engineering	gsantos@espol.edu.ec
Fernanda Bertucces Cordeiro	Biomedicine.	fbertuc@espol.edu.ec
Katiuska Paola Calle Delgado	Ecotoxicology, environmental toxicology, environmental health and ecology.	pcalle@espol.edu.ec
Washington Bolívar Cárdenas Medranda	Molecular virology and immunology.	wbcarden@espol.edu.ec
Diego Fernando Quito Ávila	Plant biology.	dquito@espol.edu.ec
Ricardo Villalba Briones	Conservation of fauna and flora	rvillalba@espol.edu.ec
Andrea Sofía Reyes Chejin	Environment Axis	asreyes@espol.edu.ec
Daynet Sosa del Castillo	Agricultural biotechnology	dasosa@espol.edu.ec
Maria Fernanda Ratti Torres	Plant pathology and microbial communities	mratti@espol.edu.ec

Faculty

The life sciences faculty is located on the Main Avenue of the Escuela Superior Politécnica del Litoral in the city of Guayaquil; the facilities have offices, classrooms and laboratories for authorities and students. The faculty has several research laboratories for the biology students; it also has a greenhouse and a wide variety of green areas.

Core Requirements

Those who wish to study Biology at ESPOL must meet the following requirements:

1. The applicant must pass ESPOL's admission process.
2. The applicant must register on the SENESCYT web page.
3. The applicant must apply for their chosen career at ESPOL's admission web page.
4. The students who obtain a quota will be able to take the levelling course to enter their first semester in their chosen career.

Course Summary

Name of Program	Bachelor of Biology
Mode of the study	Full time
number of semesters	8 semesters
Normal length of the programme	4 years
Location of study	ESPOL
Accreditation (if applicable)	not applicable
Regulator	Office for Students

Curriculum

For the student to complete the study plan, they must complete 56 subjects with a total of 73 credits, of which: 65 credits belong to subjects that are compulsory, 2 credits to complementary subjects and 6 credits to subjects of the itinerary. The student will be able to start their community service practices when they have completed 60% of their university career. The student will be able to start their business practices when they have completed 70% of their degree.

Each semester students can take a maximum of 15 and a minimum of 12 total credits. Of the 73 total credits, 65% correspond to basic training subjects and the remaining 35% belong to professional training subjects.

SEMESTER	COURSE	TEACHING HOURS	CREDITS	TYPES OF COURSE	PREREQUISITE
FIRST SEMESTER	SINGLE VARIABLE CALCULUS	5	3	BASIC	THIS SUBJECT HAS NO REQUIREMENTS
	GENERAL PHYSICS	4	3	BASIC	THIS SUBJECT HAS NO REQUIREMENTS
	GENERAL CHEMISTY	4	3	BASIC	THIS SUBJECT HAS NO REQUIREMENTS
	PROBLEM SOLVING	3	3	BASIC	THIS SUBJECT HAS NO REQUIREMENTS
	COMPLEMENTARY 1	2	2	BASIC	THIS SUBJECT HAS NO REQUIREMENTS
	ENGLISH 1	4	2	BASIC	THIS SUBJECT HAS NO REQUIREMENTS
	SUBTOTAL	22	16		
SECOND SEMESTER	CALCULUS OF SEVERAL VARIABLES	5	3	BASIC	SINGLE VARIABLE CALCULUS
	PROGRAMMING FUNDAMENTALS	4	3	BASIC	SINGLE VARIABLE CALCULUS
	ORGANIC CHEMISTRY	4	2	BASIC	GENERAL CHEMISTY

	GENERAL BIOLOGY	4	2	BASIC	GENERAL CHEMISTY
	GENERAL BOTANY	4	2	PROFESSIONAL UNIT	GENERAL BIOLOGY
	ENGLISH 2	4	2	BASIC	ENGLISH 1
	SUBTOTAL	25	14		
THIRD SEMESTER	STATISTICS	4	3	BASIC	CALCULUS OF SEVERAL VARIABLES
	COMMUNICATION	4	2	BASIC	6 APPROVED SUBJECTS
	BIOCHEMISTRY	4	2	PROFESSIONAL UNIT	ORGANIC CHEMISTRY
	CELLULAR AND MOLECULAR BIOLOGY	4	2	PROFESSIONAL UNIT	GENERAL BIOLOGY
	INVERTEBRATE ZOOLOGY	4	2	PROFESSIONAL UNIT	GENERAL BIOLOGY
	SYSTEMATIC BOTANY	3	2	PROFESSIONAL UNIT	GENERAL BOTANY
	ENGLISH 3	4	2	BASIC	ENGLISH 2
	SUBTOTAL	27	15		

FOURTH SEMESTER	LIFE SCIENCES RESEARCH	3	2	PROFESSIONAL UNIT	THIS SUBJECT HAS NO REQUIREMENTS
	SUSTAINABILITY SCIENCES	3	3	BASIC	20 APPROVED SUBJECTS
	GENERAL ECOLOGY	3	2	PROFESSIONAL UNIT	GENERAL BIOLOGY
	GENERAL MICROBIOLOGY	4	2	PROFESSIONAL UNIT	CELLULAR AND MOLECULAR BIOLOGY
	ENTOMOLOGY	3	2	PROFESSIONAL UNIT	INVERTEBRATE ZOOLOGY
	VERTEBRATE ZOOLOGY	4	2	PROFESSIONAL UNIT	INVERTEBRATE ZOOLOGY
	ENGLISH 4	4	2	BASIC	ENGLISH 3
	SUBTOTAL	24	15		
FIFTH SEMESTER	ENTREPRENEURSHIP AND INNOVATION	4	3	BASIC	20 APPROVED SUBJECTS
	BIOSTATISTIC	3	2	BASIC	STATISTICS
	ECOSYSTEM ECOLOGY	4	2	PROFESSIONAL UNIT	ENTOMOLOGY GENERAL ECOLOGY

	GENETICS	3	2	PROFESSIONAL UNIT	GENERAL MICROBIOLOGY
	EMBRYOLOGY	3	2	PROFESSIONAL UNIT	GENERAL MICROBIOLOGY VERTEBRATE ZOOLOGY
	PLANT PHYSIOLOGY	2	2	PROFESSIONAL UNIT	BIOCHEMISTRY SYSTEMATIC BOTANY
	ENGLISH 5	4	2	BASIC	ENGLISH 4
	SUBTOTAL	23	15		
SIXTH SEMESTER	ENVIRONMENTAL POLLUTION	3	2	PROFESSIONAL UNIT	ECOSYSTEM ECOLOGY
	BIOINFORMSTICS	3	3	PROFESSIONAL UNIT	BIOSTATISTIC GENETICS
	AQUATIC ECOLOGY	4	2	PROFESSIONAL UNIT	ECOSYSTEM ECOLOGY
	EVOLUTION	3	2	PROFESSIONAL UNIT	EMBRYOLOGY GENETICS
	VIROLOGY	4	2	PROFESSIONAL UNIT	EMBRYOLOGY
	SUBTOTAL	17	11		

SEVENTH SEMESTER	INTRODUCTION TO OMICS TOOLS	3	2	PROFESSIONAL UNIT	BIOINFORMSTICS
	PRINCIPLES OF ECOTOXICOLOGY	4	3	PROFESSIONAL UNIT	AQUATIC ECOLOGY ENVIRONMENTALPOLLUTION
	BIOGEOGRAPHY	4	2	PROFESSIONAL UNIT	EVOLUTION
	IMMUNOLOGY	4	2	PROFESSIONAL UNIT	VIROLOGY
	ANIMAL PHYSIOLOGY	3	2	PROFESSIONAL UNIT	EMBRYOLOGY
	ITINERARY			PROFESSIONAL UNIT	30 APPROVED SUBJECTS
	SUBTOTAL	18	11		
EIGHTH SEMESTER	ENVIRONMENTAL REMEDIATION	4	2	PROFESSIONAL UNIT	PRINCIPLES OF ECOTOXICOLOGY
	COMPLEMENTARY 2	2	1	BASIC	THIS SUBJECT HAS NO REQUIREMENTS
	INTEGRATIVE SUBJECT OF BIOLOGY	3	3	PROFESSIONAL UNIT	44 APPROVED SUBJECTS

	ITINERARY			PROFESSIONAL UNIT	30 APPROVED SUBJECTS
	SUBTOTAL	9	6		
	TOTAL	165	73		

Learning outcomes

The following table shows the learning outcomes for each subject. The learning outcomes are what students learn in the program.

First semester

COURSE	LEARNING OUTCOMES
SINGLE VARIABLE CALCULUS	1. - Apply topological notions for the calculation of limits and continuity analysis. 2. - Analyse the behaviour of functions of a real variable using limit conditions, continuity and derivability. 3. - Interpret the solutions in problems of approximation, rate of change and extreme values, using differential calculus. 4. - Obtain antiderivatives through various integration techniques. 5. - Solve calculation problems of areas, volumes, and arc lengths, using the definite integral.
GENERAL PHYSICS	1. - Describe the phenomena of particle movement and the use of magnitudes physical for the introduction to the basic concepts of this science. 2. - Apply Newton's laws for particles and the concepts of quantity of linear motion in solving basic mechanics problems.

	3. - Understand the principle of conservation of energy and the different forms of energy in thermodynamics as a basis for understanding motion and behaviour of particles, bodies, and materials. 4. - Exemplify applications of electromagnetic principles for life situations every day.
GENERAL CHEMISTY	1. - Understand the changes that occur in substances, pure and in mixtures, from the knowledge of their physicochemical properties and the dynamics of their mixtures and reactions. 2. - Apply the laws, principles, and basic concepts of chemistry to solve problems related to the contents of the program. 3. - Interpret the principles that govern the physicochemical phenomena studied, applying them in laboratory tests.
PROBLEM SOLVING	1. - Identify problems using research and empathy tools to deeply understand them. 2. - Define a problem using different systematic and methodological processes of Design Thinking to generate innovative solutions. 3. - Propose innovative solutions using prototyping and validation tools to evaluate their desirability, feasibility, and viability. 4. - Argue how a solution proposal satisfies identified need(s) through the application of communication techniques.
ENGLISH 1	1. - To understand the main ideas of a monologue or dialogue from a familiar topic. 2. - To examine information on texts whose topics are family, society, and education topics. 3. - To develop oral communication using dialogues, interviews, conversations or simple presentations about familiar topics. 4. - To write short texts on everyday topics using the vocabulary and grammatical structures learned.

Second semester

COURSE	LEARNING OUTCOMES
MULTIVARIABLE CALCULUS	1. - Solve problems in three-dimensional analytical geometry using the concepts of surfaces, lines, and planes. 2. - Analyse the results of limits, continuity, derivability, and differentiability of functions of several variables using definitions and theorems. 3. - Solve approximation and optimization problems, using the notion of gradients.
PROGRAMMING FUNDAMENTALS	1. - Apply computational methods to solve problems in their field of study using a programming language. 2. - Use computational tools to model and understand data. 3. - Apply recipe algorithms in problem solving. 4. - Use a development environment to write and debug programs. 5. - Use modularization to simplify the structure of a program.
ORGANIC CHEMISTRY	1. - Use the IUPAC nomenclature system for the molecular formulation and structural drawing of organic compounds. 2. - Establish the relation between the chemical structures of organic compounds with their physical properties and industrial application. 3. - Perform laboratory tests for the characterization of functional groups in simple organic substances. 4. - Apply unit operations in the laboratory for the isolation and purification of an organic compound from a mixture.
GENERAL BIOLOGY	1. - Connect biology with other sciences as a scientific tool for the study of living organisms. 2. - Study the biological molecules, the cell, its components, how it works and reproduces to understand the essential basis of life.

	3. - Understand the genetic bases of inheritance that determine how genes interact and express in biological and technological processes that govern life.
GENERAL BOTANY	1. - Recognize the role of plants in the biosphere to appreciate their influence in the development of ecosystems and humanity. 2. - Study the various types of plant cells and tissues, as well as the characteristics morphological and anatomical for the identification of plant structures. 3. - Analyse the general concepts about the natural history of plants, their origin and dispersion centres, as well as the systematic bases for their adequate identification and taxonomic classification.
ENGLISH 2	1. - Understand conversations and audios of everyday scenarios to identify the main ideas. 2. - Analyse information from academic and everyday texts to understand the main ideas. 3. - Develop oral communication through conversations, discussions and/or presentations on familiar topics. 4. - Prepare academic paragraphs using an intermediate level of English.

Third semester

STATISTICS	1.- Statistical analysis of data to turn it into useful information 2. - Associate everyday situations using models of continuous or discrete random variables. 3.- Apply statistical inference that identifies and minimizes risks in decision-making
COMMUNICATION	1. - Analyse with a critical sense the disciplinary and contemporary discourse, through the reading relevant texts for a holistic understanding of academic information.

	2. - Produce contemporary-academic written texts in the structure of a Report academic, for the configuration of its organized, coherent written expression, in accordance with the academic literacy. 3. - Explain orally academic and contemporary content, within the framework of regulations of communicational behaviour for the formation of an academic speech effective.
BIOCHEMISTRY	1. - Solve conceptual problems applying biochemical knowledge in the field of Biological Sciences. 2.- Understand the chemical and molecular bases of the biomolecules that constitute life for the recognition of the metabolic processes that take place in living beings 3.- Apply basic analytical techniques for the identification of biomolecules and interpretation of results
CELLULAR AND MOLECULAR BIOLOGY	1. - To understand the structure and function of cellular membrane, cytoskeleton and organelles. 2. - To describe the energy flux and metabolic process that occur in the cells. 3.- To recognize the worth of molecular and biochemical process which lead information genetic expression
INVERTEBRATE ZOOLOGY	1. - Recognize the anatomical, physiological, and ecological characteristics of the different phyla for the identification of evolutionary distances. 2. - User the taxonomic keys to classify invertebrates by means of current scientific terminology. 3. - Apply the techniques of observation, collection, and preservation and healing of invertebrates, for the creation of biological collections.
SYSTEMATIC BOTANY	1. - Understand principal taxonomic characters through specialized information for the study of plant biodiversity in an ecosystem.

	2. - Analyse the taxonomic classification systems and scientific nomenclature by means of plant systematics-related criteria for the identification of the main plant groups. 3. - Compare different taxonomic keys through guides developed for the classification and identification of biodiversity and plant specimens.
ENGLISH 3	1. - Examine a variety of audios through interviews, conversations, discussions, and lectures to promote experience and knowledge on listening skills. 2. - Analyse the information in texts on contemporary issues through articles in the guidebook and investigations that allow the development of comprehensive reading skills. 3. - Practice exchanging arguments through debates, discussions, and conversations on contemporary and academic topics to promote oral fluency. 4.- Develop compositions in a structured way, using thematic ideas, supporting ideas, details, examples, and conclusion to improve writing skills

Fourth semester

LIFE SCIENCES RESEARCH	1. - Logically and coherently formulate research problems from questions or observations based on potential ideas to find solutions and generate new knowledge. 2. - Contrast the different research approaches (qualitative and quantitative) for the design of research proposals. 3. - Apply the scientific method for the development of a research project in life sciences.
SUSTAINABILIT SCIENCES	1. - Relate environmental, economic, and social variables as the central axis of sustainability by applying basic sciences to understand the importance of sustainability. 2. - Develop critical thinking through the reflection of ethical values, norms and practices, for the adoption of a position in the discourse of sustainability.

	3. - Propose solutions to complex sustainability problems at the local, regional and global levels for the analysis of alternatives that contribute to sustainable development. 4. - Analyse ethical and professional responsibilities in work situations, making informed judgments, considering the impact of solutions in global, economic, environmental and social contexts.
GENERAL ECOLOGY	1. - Distinguish the hierarchical levels within an ecosystem to understand the patterns and processes that result from the interaction of living beings in their natural environment. 2. - Examine ecological processes by using diverse tools such as mathematical models, statistical calculations, and computer simulations software. 3. - Compare ecological interactions between organisms and the environment to interpret ecological concepts of populations and communities.
GENERAL MICROBIOLOGY	1. - Identify the different groups of microorganisms found in the environment through the performance of phenotypic and molecular methods. 2. - Discover the metabolic paths that microorganisms use in order to obtain nutrients and energy for their survival in different types of environments. 3.- Discover the main features to be considered in order to select microorganism models for scientific research and the development of biotechnological processes
ENTOMOLOGY	1. - Identify the basic parts of insects and their morphological characteristics suitable for taxonomic classification. 2. - Correctly differentiate each of the insect orders and their functions to its potential use in biological and productive processes. 3. - Execute different methods of collection, assembly and preservation of insects for their correct identification using taxonomic keys and their applications in scientific studies.
VERTEBRATE ZOOLOGY	1. - Recognize the characters of each group of vertebrates by studying their taxonomy to understand their phylogenetic classification.

	2. - Relate the morphological and physiological adaptations of the different vertebrate lineages through the study of the ecological niches of representative species. 3. - Infer on the evolutionary mechanisms of vertebrates for the identification of diversity patterns in different ecosystems.
ENGLISH 4	1. - Identify the general idea and specific arguments, through audios of conversations, conferences or interviews, for the effective development of the comprehension ability. 2. - Develop the oral ability through conversations or discussions in pairs or groups, about events and personal or professional experiences, for the improvement of the communication and oral fluency. 3. - Perform a presentation with information related to the academic and personal interests to practice for future professional talks. 4. - Structure a persuasive essay, using an upper-intermediate level of English to develop the academic writing abilities. 5. - Examine, through reading exercises, information of articles, reports, news and talks to comprehend different kinds of topics.

Fifth semester

ENTREPRENEURSHIP AND INNOVATION	1. - To assess the importance of developing our own entrepreneurial skills to face the difficulties and benefits of the entrepreneurial process for professional life. 2. - To research the environment to recognize problems, needs and opportunities to create value for society. 3. - To apply tools for the design of business models related to innovative products / services using valid reference frameworks.
BIOSTATISTIC	1. - Properly obtain experimental or observational data, with the proper statistical support. 2. - Identify factors that contribute to the variability of biological responses.

	3. - Analyse data from living beings and their environment, obtained from relational or causal studies, to make statistically supported decisions. 4. – Discuss, orally and in writing, the results obtained in a scientific investigation; presenting the findings numerically or graphically in an appropriate way, with a scientific approach.
ECOSYSTEM ECOLOGY	1. - Explain the pathways, efficiency, and energy flow constraints in ecosystems for a better understanding of productivity dynamics and material decomposition. 2. - Describe the main ecosystem features and the tools used by ecologists for a deep analysis and management of ecosystems. 3. - Identify the regional patterns that determine the diversity of ecosystems in Ecuador to understand the possible strengths and weaknesses including their structures and processes.
GENETICS	1. - Describe the genotypic and phenotypic patterns for the analysis of the transmission of hereditary characters through the study of molecular mechanisms and the laws of Mendel. 2. - Analyse the factors that alter gene expression by studying the pre- and posttranscriptional modifications. 3. - Validate the fundamentals of recombinant DNA by studying molecular techniques and genetic engineering for the characterization of organisms.
EMBRYOLOGY	1. - To describe the processes of production and cell differentiation during gametogenesis and fertilization, to compare the life cycles of different organisms. 2. - To identify spatial relations of embryos during different phases of development, by identification of relevant structures. 3.- To relate morphological, cell, and molecular aspects of developmental biology of different embryos to comprehend evolutionary changes and organism adaptation capacity

PLANT PHYSIOLOGY	1. - Describe the water relations between soil, plant, atmosphere and properties of water for understanding the functions of essential element transport and metabolism on the plant. 2.- Analyse photosynthesis as a form of autotrophic feeding, for understanding of the photosynthetic mechanisms that plants present according to the adaptation to the environment in the that they inhabit 3. - Relate the physiological functions of plants with their environment for the proposal of management alternatives for ecological systems.
ENGLISH 5	1. - To identify the general idea and specific arguments in conversations through talks and videos. 2. - To examine information from complex texts, through a variety of readings on contemporary topics, facilitating autonomous learning of the English language throughout life. 3. - To discuss familiar topics through conversations without prior preparation. 4. - To formally present a topic by making a presentation of information related to their academic and / or personal interests. 5.- To structure a persuasive essay using an upper-intermediate level of English

Sixth semester

ENVIRONMENTALPOLLUTION	1. - Interpret the units of measurements used in the determination of pollutants in the environment using graphs, statistical calculations, and analysis of the scientific literature. 2. - Apply the basic concepts and descriptions of pollution science to determine and evaluate the impacts caused by pollution in the environment. 3. - Analyse the effects caused by pollutants in the environmental matrices to implement better strategies for the environmental pollution prevention.

BIOINFORMSTICS	1. - To identify bioinformatics problems for the appropriate selection of tools for the management and processing of complex processes. 2. - To apply bioinformatics tools for the interpretation of massive data of biological origin. 3. - To evaluate the results obtained by bioinformatics analysis for the understanding of biological principles at the level of DNA, RNA, and protein level.
AQUATIC ECOLOGY	1. - Explain ecological patterns and processes at different scales through the comparative analysis of organizational structure to understand the functioning of aquatic ecosystems. 2. - Differentiate the main biotic and abiotic components through field and laboratory studies to understand the heterogeneity of processes and influential phenomena. 3. - Analyse the physical, chemical, and biological factors that regulate the ecological processes of aquatic systems for the understanding of their dynamics.
EVOLUTION	1. - To comprehend the evidence that support evolutionary biology, by studying theories that scientifically describe morphological and genetic aspects of studied organism. 2. - To identify the relation between genetics and evolutionary changes in different populations, by studying molecular events that support population dynamics and biodiversity. 3. - To compare microevolution and macroevolution roles, by identifying evolutionary mechanism that will contribute to the development of different taxon.
VIROLOGY	1. - To understand the viral replication and transcription processes for determining their infectious nature. 2. - To distinguish the diverse mechanisms of antiviral immune responses in order to develop strategies for the induction of virus resistance. 3. - To apply fundamental knowledge for implementing epidemiological studies.

Seventh semester

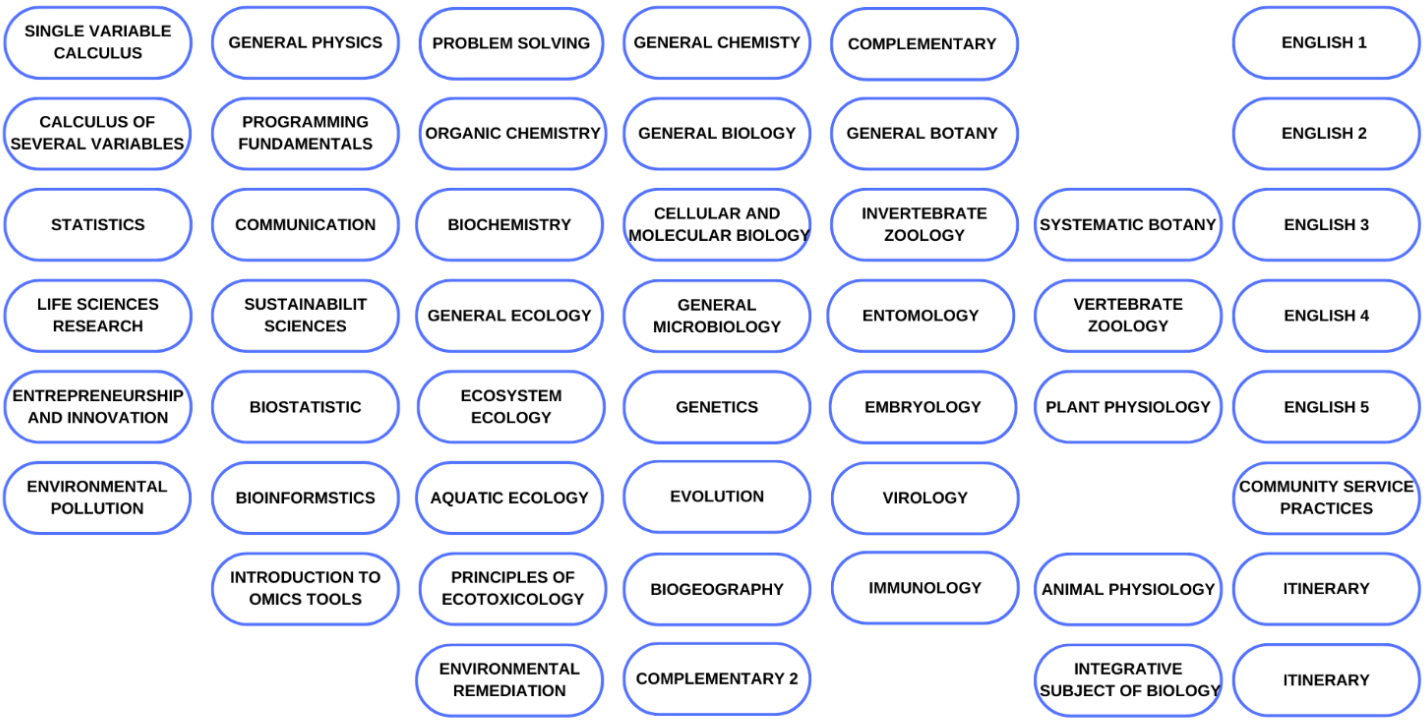
INTRODUCTION TO OMICS TOOLS	1. - To evaluate the importance of the different omics tools for their applications in biological systems. 2. - To analyse the physiological state of biological systems using omics tools. 3. - To argue the scope of the omics tools through the analysis of biological systems.
PRINCIPLES OF ECOTOXICOLOGY	1. - Analyse the pollutants disposal and biotransformation to understand the intake, distribution, metabolism, and elimination processes in living beings. 2. - Analyse the pollutant effects at the individual, population, community, and ecosystem levels by understanding the pollutant implications for the environmental health. 3. - Analyse the pollutant effects on the biota by using bioassays. 4. - Propose risk management measures in the face environmental contamination situations.
BIOGEOGRAPHY	1. - Understand the role of historical factors that shape biodiversity through the study of its distribution and species richness. 2. - Identify the predictive parameters for understanding how biodiversity responds to a constantly changing environment. 3. - Infer about the distribution and abundance of species through the application of phylogenetic models of population analysis to understand diversity change biology over time.
IMMUNOLOGY	1.- Describe the main components of the innate and acquired immune response that organisms use at the cellular and molecular level to fight foreign molecules 2. - Relate the immune response to pathogenesis caused by bacteria, viruses, cancer, autoimmunity, and tissue transplant.

	3.- Relate the immune processes to their application to the industry in diagnostics and treatments
ANIMAL PHYSIOLOGY	1. - Recognize that the animal organization requires a continuous flow of energy through the construction of the metabolic pathways of animals, using nutrients as sources of biomolecules. 2. - Describe the mechanisms of regulation of homeostasis, integrating the components and functions of the circulatory, respiratory, and excretory systems of vertebrates and invertebrates for the assessment of the role of each animal function in maintaining the balance of the internal environment. 3. - Identify the neuronal and hormonal systems, analysing their mechanisms of integration and physiological control to recognize that animals coordinate and integrate all their functions.

Eighth semester

ENVIRONMENTAL REMEDIATION	1. - Comprehend the scientific and technological principles of remediation methods applied to a polluted ecosystem or site. 2. - Analyse the different restoration technologies for the selection of the appropriate methodologies for a polluted ecosystem or site. 3. - Evaluate the restoration grade of the polluted site once the remediation method has been applied.
INTEGRATIVE SUBJECT OF BIOLOGY	1. - Identify the problem/need through the study of the requirements of the client, user, or public. 2. - Analyse the different critical factors for proposing solutions to the identified problem/need. 3. - Design alternative solutions and/or prototypes using methodologies inherent to biology. 4. - Generate a feedback process on the alternative of the designed solution.

Curriculum


SINGLE VARIABLE CALCULUS
GENERAL PHYSICS
PROBLEM SOLVING
GENERAL CHEMISTY
COMPLEMENTARY
ENGLISH 1
CALCULUS OF SEVERAL VARIABLES
PROGRAMMING FUNDAMENTALS
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GENERAL BIOLOGY
GENERAL BOTANY
ENGLISH 2
STATISTICS
COMMUNICATION
BIOCHEMISTRY
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ENGLISH 3
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ENGLISH 4
ENTREPRENEURSHIP AND INNOVATION
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GENETICS
EMBRYOLOGY
PLANT PHYSIOLOGY
ENGLISH 5
ENVIRONMENTAL POLLUTION
BIOINFORMSTICS
AQUATIC ECOLOGY
EVOLUTION
VIROLOGY
COMMUNITY SERVICE PRACTICES
INTRODUCTION TO OMICS TOOLS
PRINCIPLES OF ECOTOXICOLOGY
BIOGEOGRAPHY
IMMUNOLOGY
ANIMAL PHYSIOLOGY
ITINERARY
ENVIRONMENTAL REMEDIATION
COMPLEMENTARY 2
INTEGRATIVE SUBJECT OF BIOLOGY
ITINERARY

Requirements

For students to be able to stay in the biology course, it is necessary to meet a series of academic requirements. These requirements are intended to help students make adequate progress toward achieving the goal of earning a biology degree.

● Minimum grade of 6.0 in all subjects

Students who do not reach this required grade on their final grade for the first time will fail the class and have another opportunity to repeat the subject. If students do not reach the grade of 6.0 on their second attempt, they would need to formally appeal to the authorities in order to get another opportunity to repeat said class. In the case of a student's request being rejected, the department will withdraw said student from the course. As a last point, the student will have the opportunity to meet up with the relevant authorities and decide if they wish to study a new career that does not involve the failed class on its syllabus.

Internships and Projects

Espol's Biology department offers students learning opportunities through internships and research. Students have the chance to work alongside their professors on important research projects thanks to the internship program, where students often work in laboratories, fields and industries. In this programme, students may work on institutions such as (but not limited to):

CIBE

CENAIM

BIOMED

INSPI

BDP

Professional skills

The graduates of the Biology career, whose professional training axes are Biotechnology, Environmental Biology and Biodiversity, are professionals of excellence with cultural, ethical, environmental and social principles and values; with solid and up-to-date knowledge of living beings from the molecular level to their interaction in different ecosystems. After 4 years of study, you will be able to: Recognize problems related to living beings through the study of Biology. Promote the sustainable management of the country's strategic natural resources soil, water, air, subsoil, forests and biodiversity. Link and participate, with investigative and management aptitude, in projects with multidisciplinary groups at a national and international level.

Professional profile

The profile of our graduates is required in the public sector because the career it is aligned with conservation, biodiversity, and environmental quality; chores exclusive to the Central Government and the Decentralized Autonomous Governments.

Other development spaces for our graduates are in the sector private, both in environmental consulting agencies, NGOs, laboratories associated with the field of Biotechnology and in the productive sector, (example shrimp farms).

Biology Clubs and Student Organizations

Students who are studying the Biology program at Escuela Superior Politecnica del Litoral can join and take part in activities organized by various clubs and organizations of the university. For example:

Biosoc

Biosoc is an organization created by a group of Biology students whose purpose is to contribute to the professional growth of all students in the career.

Miel del bosque

Miel del Bosque is a club created by a group of teachers and students. This club allows the students to oversee honey production.