

Environmental and Wildlife Management 145.C0 Course Frameworks

Course Title	Cell Biology
Course Code	101-111-VA
Competencies	044C: To carry out laboratory analyses.
Ponderation	3-2-2
Credits	2 1/3
Prerequisites	
Links: Backward	NA
<i>Forward</i>	101-211-VA Botany, 101-221-VA Vertebrate Form and Function 1, 101-231-VA Microbiology, 101-411-VA Invertebrate Zoology
<i>Current Semester</i>	202-111-VA General Chemistry
<p>Course Description In this course, the student will be introduced to cellular biology. The course will look at the principles in biological processes at the cell level. Topics covered are an introduction to biology, biomolecules, cell structure and function, metabolism, photosynthesis, cellular respiration, cell division and the bases of genetics. The laboratories will allow the student to experiment with different techniques in applying knowledge seen during the course.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> For all types of research focusing primarily on ecosystem characterization, including conservation and restoration (not really in cell biology) While conducting biochemical, physicochemical and genetic analyses Working generally alone, with supervision and complying with all ethical considerations Based on defined or standardized research methods and protocols, in particular, gravimetric and non-gravimetric separation, microscopy, photometry,; provided soil, water and organism samples and all related relevant information; a predetermined deadline and budget as well as predetermined formats for data input Using the required procedures documentation, apparatus, instruments and tools as well as all the means related to logistical aspects 	<ul style="list-style-type: none"> In class: <ul style="list-style-type: none"> Lectures Discussions Textbook Class notes In lab: <ul style="list-style-type: none"> Working alone or in pairs Lab manual Microscope techniques Gravimetric techniques Lab safety
Competency 044C: To carry out laboratory analyses.	
Element 1: Plan the work under their responsibility.	
Performance Criteria	Learning Outcomes
<ul style="list-style-type: none"> Determination of the sequence of all the steps involved in performing the work Determination of all required organizational and material means as well as the conditions for implementing them Consideration of all important health and safety 	<p>Students will be able to:</p> <ul style="list-style-type: none"> Understand and apply the steps in performing the experiments carried out Understand and apply health and safety in a laboratory setting.

aspects	
Element 2: Perform the preliminary work required for the analyses.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper assembly, adaptation and calibration of equipment • Accurate calculations for the dilution and concentration of solutions • Accurate conversions of concentration units • Methodical preparation of solutions, using volumetric instruments and the required materials 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Understand and use laboratory equipment used in the laboratory exercises • Demonstrate correct use of measurements, converting units when necessary • Prepare solutions and calculate dilutions
Element 3: Perform biochemical, physicochemical and genetic analyses.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant proposals for minor adaptations according to the defined protocol • Rigorous application of analysis methods and adequate use of corresponding work techniques • Proper use of apparatus • Results in conformity with the defined study parameters • Rigorous application of health and safety measures, and respect of standards in effect 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Adjust to new situations in the laboratory • Apply rigour in observations taken • Respect Health and Safety procedures during laboratory exercises

Course Title	Botany
Course Code	101-211-VA
Competencies	044G: To analyze how fungi and plants live in and adapt to their environment. 044J: To culture and maintain organisms.
Ponderation	2-3-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-111-VA Cell Biology
Forward	101-311-VA Ecology, 145-431-VA Bioremediation and Waste Management, 145-511-VA Plant Taxonomy, 145-621-VA Plant Inventory
Current Semester	None
Course Description	
Plants, algae and fungi are studied with emphasis on their structure, functioning and classification. Major topics such as internal transport, photosynthesis, gas exchange, mineral nutrition and hormonal regulation are emphasized, especially in regards to vascular plants. Distinctive features in all groups are compared and contrasted using an evolutionary approach. Culturing and classification techniques are applied on an ongoing basis throughout the duration of the course.	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> Working alone on research that involves characterizing biotic and abiotic resources in natural and controlled environments While conducting analyses related to organisms Based on live or dead specimens and samples; specimens that have been given to or collected by the technician or that derive from a natural environment; information on the environment and the living conditions of fungi and plants; as well as established or standardized research protocols Using the required apparatus, lab tests, documentation, procedures and databases For all types of research focusing primarily on ecosystem characterization, including conservation and restoration While performing tasks related to culture and breeding, bioassays, in vitro culture and the conservation of scientific collections Working alone or in a team, with supervision and complying with all ethical considerations Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects 	<ul style="list-style-type: none"> In class: <ul style="list-style-type: none"> Lectures Discussions Textbook Class notes In lab: <ul style="list-style-type: none"> Working alone or in pairs Lab manual Lab exercises Plant culture Field trips
Competency 044G: To analyze how fungi and plants live in and adapt to their environment.	
Element 1: Process the samples in order to isolate the fungi.	
Performance Criteria	Learning Outcomes
<ul style="list-style-type: none"> Accurate determination and proper, safe application 	Students will be able to: <ul style="list-style-type: none"> Isolate fungi from a natural mixture and

<ul style="list-style-type: none"> of techniques for taking and processing samples. • Proper use of the required apparatus • Rigorous application of the required asepsis measures • Isolation and conservation of all fungi present 	<p>transfer them to nutrient agar in petri dishes using sterile and basic asepsis techniques.</p>
<p>Element 2: Characterize the fungi and plants in order to identify them.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of the techniques and methods associated with culturing, transplanting and identifying fungi and plants • Use of apparatus associated with identifying fungi and plants according to established or standardized protocols • Proper application of health, safety and asepsis measures • Accurate description of the anatomical and morphological characteristics of fungi and plants • Identification of the fungi and plants present at the taxonomic level required by the research parameters 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Use texts, manuals, keys and the Internet to determine various growth and preservation techniques of plants and fungi. • Key out various plant and fungi using recognized field guides and binomial keys. • Identify and plan for lab and field trip safety issues. • Observe and discuss key distinctions between various plant and fungi families will be discussed and observed. • Use identification keys and field surveys in the lab and discussions of plant and fungi hierarchies during lectures will be implemented.
<p>Element 3 : Explain the connections between fungi and plants and their respective habitats.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant explanation of the main physiological mechanisms of fungi and plants according to their specificities • Relevant explanation of the role of fungi and plants in their respective habitats • Forecast assessment of the impact of environmental changes on the ability of fungi and plants to adapt and survive 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Describe physiological concepts such as internal transport, stomatal action (in plants), regulatory mechanisms involving hormones and tropisms will be discussed. • Describe and analyse ecological and commercial studies of plants and fungi will be accomplished by reading and discussing various essays and participating in a field trip. • Assess the adaptive ability of plants and fungi over time.
<p>Competency 044J: To culture and maintain organisms.</p>	
<p>Element 1: Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Culture various plants in the lab from seeds, cuttings and bulbs using techniques demonstrated by the instructor. • Discuss the costs involved with each type of culture technique. • Examine the time needed for plants to reach maturity to determine the feasibility of indoor culture. • Observe applicable safety precautions.
<p>Element 2 : Perform tasks related to the culture, breeding and <i>in vitro</i> culture of organisms, as well as bioassays.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of techniques and methods associated with the different types of tasks 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Observe cultured plants on a week-to-week basis

<ul style="list-style-type: none"> • Appropriate use of the required means • Ability to work independently in order to fine-tune the methods, techniques and protocols suited to the circumstances • Effective resolution of all problems encountered during the work • Accurate, ongoing determination of the indicators observed • Accurate, precise interpretation of results in order to formulate a diagnostic impression of the condition of the environment 	<p>and record growth changes using standard methodology.</p> <ul style="list-style-type: none"> • Work independently. • Interpret results independently.
<p>Element 3 : Perform tasks related to the conservation of scientific collections.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper sampling and collection of the specimens required • Preparation of specimens according to the specific requirements of a scientific collection • Identification of the specimens at the required taxonomic level • Proper use of apparatus • Proper use of classification systems specific to the taxon studied • Rigorous application of conservation methods 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Collect twigs from various tree species using proper techniques. • Classify twigs using keys as to their “Family, Genus, specific epithet and common name”. • Mount each specimen on proper herbarium paper.
<p>Element 4 : Compile all the data.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete, correct inputting of data on worksheets • Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Enter data on data sheets • Verify correct data entry
<p>Element 5 : Keep a technical log.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of materials and products used as well as the organisms studied • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> – methodology – work context and conditions 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Write a full report according to scientific standards

Course Title	Vertebrate Form and Function 1	
Course Code	101-221-VA	
Competencies	0449: To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it. 044E: To convey information about a natural environment. 044H: To analyze how animals live and adapt to their environment. 044J: To culture and maintain organisms. 044U: To apply scientific approach to problem-solving in a natural environment.	
Ponderation	3-2-3	
Credits	2 2/3	
Prerequisites	Outlook on the Environment, Cell Biology	
Links: Backward	101-111-VA Cell Biology	
Forward	101-321-VA Vertebrate Form and Function 2, 101-311-VA Ecology, 145-311-VA Vertebrate Taxonomy	
Current Semester	None	
Course Description		
This is the first of a two-course series on vertebrate anatomy (study of form) and physiology (study of function). This course will explore the following vertebrate body systems: support, protection and movement; nervous coordination; digestion and basic nutrition; and chemical coordination.		
ACHIEVEMENT CONTEXT	LEARNING CONTEXT	
<ul style="list-style-type: none"> Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer equipment and any other appropriate apparatus While conducting analyses related to organisms Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases Working alone or in a team, with supervision and complying with all ethical considerations Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects For research conducted alone, under supervision and in the field and in a lab Based on concrete study, analysis and intervention situations where problems require that lab protocols and methods be adjusted or modified or that practices for intervening in the natural environment be modified according to specific conditions and constraints Using the required scientific and technical documentation, tools, computer applications, equipment, apparatus and products 	<ul style="list-style-type: none"> In class: <ul style="list-style-type: none"> Lectures Directed reading assignments Discussions In lab: <ul style="list-style-type: none"> laboratory manual Reference texts Histology Animal dissection Experiments on the nervous system, digestion. 	
Competency 0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.		
Element 4 : Explain how the physical components of an environment determine the living conditions of the organisms that inhabit it.		

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Description of the main abiotic ecological constraints inherent in the environment in terms of the living functions of the organisms that inhabit it • Explanation of the main mechanisms by which organisms adapt their anatomy, physiology and morphology to environmental requirements 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • List biological constraints of an environment for organisms inhabiting an environment. • Describe how organisms adapt to meet environmental requirements.
<p>Competency 044E: To convey scientific information.</p>	
<p>Element 2: Determine the objectives, approach and content of the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate, relevant objectives defined • Methodical, effective review of literature on the subject • Selection of content based on relevance to objectives pursued 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Understand how to prepare a laboratory report including introduction, materials and methods, results, conclusion and reference list. • Prepare result tables and figures.
<p>Element 3: Plan and organize the content of the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Validation of the accuracy of the content with the qualified authorities • Strategic selection of communication means and media • Content and format of materials organized in order to communicate appropriate educational and strategic information 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Validate data recorded. • Present data in an organized manner.
<p>Element 4: Produce all the elements required for the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Quality of the different communication elements produced: texts, images, tables, presentations • Appropriate popularization of the content of the communications • Use of terminology and language adapted to the target audience • General quality of the language and organization of the different communication elements • Consideration of applicable presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Prepare laboratory report. • Prepare figures and tables. • Use proper terminology in writing a laboratory report. • Apply standards in preparing a laboratory report.
<p>Element 5: Present the content of the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Consideration of different communication styles in their dealings with the target audience • General quality of the communications: coherence, clarity, accurate language 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Communicate clearly and coherently.
<p>Element 6: Evaluate the effectiveness of the communication in order to make improvements.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Strategic evaluation of the achievement of initial objectives • Identification of elements that could be improved • Accurate modification of the different elements based on the weaknesses observed 	<p><u>Learning Outcomes</u></p> <ul style="list-style-type: none"> • Students will be able to: Evaluate initial objectives of lab experiment. • Identify elements needing improvement in laboratory report. • State modifications for improving laboratory report.
<p>Competency 044H: To analyze how animals live and adapt to their environment.</p>	
<p>Element 2: Explain the connections between the characteristics of animals and their respective habitats.</p>	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant explanation of the main physiological mechanisms of animals according to their specificities • Relevant explanation of the role of animals in their respective habitats • Forecast assessment of the impact of environmental changes on the animals' ability to adapt and survive 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain how animals function in their environment. • Explain the coordinating systems, support, protection and movement systems, and the digestive systems of vertebrates. • Forecast how animals will adapt to their environment.
<p>Competency 044J: To culture and maintain organisms.</p>	
<p>Element 1: Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Plan an experiment in which organisms will be cultured and maintained.
<p>Element 4: Compile all the data.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete, correct inputting of data on worksheets • Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Tabulate data correctly onto a worksheet. • Validate data recorded.
<p>Element 5: Keep a technical log.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of materials and products used as well as the organisms studied • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> – methodology – work context and conditions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • List materials and products used during the experimentation. • List the organisms under study. • Record relevant information on methods, work context and conditions.
<p>Competency 044U: To apply scientific approach to problem-solving.</p>	
<p>Element 2: Formulate a hypothesis regarding the causes of the problem.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant hypothesis put forth • Theoretical validation of the hypothesis put forth in terms of the current knowledge on the subject • Determination of the type of approach to take • <i>A priori</i> determination of the expected results and the degrees of confirmation of the hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Write a relevant hypothesis • Validate hypothesis using theory • Determine expected results
<p>Element 3: Plan the research process.</p>	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous determination of how the work should proceed: <ul style="list-style-type: none"> – nature of parameters and data – methodological elements and corresponding steps – procedures for inputting and processing data • Determination of the required resources • Effective organization of how and where the work should take place • Consideration of all health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Plan the scientific project. <ul style="list-style-type: none"> - Define scope and goals - Determine procedures to meet goals - Determine “Materials and Methods” phase of the project - Plan in accordance with health and safety guidelines, potential hazards
<p>Element 4: Apply the chosen methodology.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of protocol • Adequate use of the techniques associated with different operations • Complete, accurate data collected • Appropriate processing of data 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply the chosen methodology. <ul style="list-style-type: none"> - Follow the standard operating procedures (SOPs) - Collect data in proper format - Process data according to the protocol
<p>Element 5: Analyze the results obtained in order to confirm or reject the hypothesis.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Detailed review of the application of the process in order to confirm that the data obtained is reliable • Identification of the main sources of errors and bias that could interfere with the quality of results and their interpretation • Systematic comparison of actual and expected results • Relevant conclusions regarding the initial hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Analyse results obtained. • Confirm or reject the hypothesis.
<p>Element 6: Write a technical report.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete report in conformity with the standards in effect for scientific presentation: <ul style="list-style-type: none"> – description of the initial problem – description of the methodology – data and results obtained – analysis of results and ensuing conclusions • Formulation of relevant recommendations: <ul style="list-style-type: none"> – generalization of the solution if the hypothesis is confirmed – formulation of a new hypothesis if the hypothesis is rejected 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Write a full laboratory report, including the following sections: introduction, material and methods, results, conclusion and recommendations and literature cited. • Formulate a new hypothesis if the current one was rejected.

Course Title	Microbiology
Course Code	101-231-VA
Competencies	044F: To analyze how microorganisms live in and adapt to their environment. 044J: To culture and maintain organisms.
Ponderation	2-2-2
Credits	2
Prerequisites	
Links: <i>Backward</i>	101-111-VA Cell Biology
<i>Forward</i>	145-431-VA Bioremediation and Waste Management
<i>Current Semester</i>	None
Course Description	
Content includes: biology, morphology, and identification of disease causing bacteria and viruses. Introduction to principles of immunology.	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • Working alone on research that involves characterizing biotic and abiotic resources in natural and controlled environments • Working with the microorganisms present in a natural or controlled environment, including the organisms that inhabit it • Based on water, soil and organism samples; information on the environment and the living conditions of microorganisms; and established or standardized research protocols • Using the appropriate smears, apparatus and microbiological and biochemical tests as well as the required documentation, procedures and databases • For all types of research focusing primarily on ecosystem characterization, including conservation and restoration • While performing tasks related to culture and breeding, bioassays, <i>in vitro</i> culture and the conservation of scientific collections • Working alone or in a team, with supervision and complying with all ethical considerations • Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input • Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects 	<ul style="list-style-type: none"> • In class <ul style="list-style-type: none"> - Lectures - Discussions - Handouts - Textbook / lab manual • In Laboratory <ul style="list-style-type: none"> - Laboratory manual - Alone or in pairs - Use of different microscopes - Handling of microbiological specimens, - Learning staining techniques, - Learning biochemical assays - Handling of samples from the environment: soil, water, stool, - Learning disinfection procedures - Learning proper disposal of contaminated material
Competency 044F: To analyze how microorganisms live in and adapt to their environment.	
Element 1: Process the samples in order to isolate the microorganisms.	
Performance Criteria	Learning Outcomes
<ul style="list-style-type: none"> • Accurate determination and proper, safe application of techniques for taking and 	Students will be able to: <ul style="list-style-type: none"> • Safely handle and transfer cultures and samples

<ul style="list-style-type: none"> processing samples • Proper use of the required apparatus • Rigorous application of the required asepsis measures • Isolation and conservation of all microorganisms present 	<ul style="list-style-type: none"> containing microorganism. • Use and maintain microscopes and other laboratory equipment. • Use aseptic techniques in handling microbiological samples and their safe disposal. • Isolate and prepare liquid and agar cultures of microorganisms.
<p>Element 2: Characterize the different microorganisms in order to identify them.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of the techniques and methods associated with culturing, transplanting and identifying microorganisms • Use of apparatus associated with identifying microorganisms according to established or standardized protocols • Proper application of health, safety and asepsis measures • Accurate description of the anatomical and morphological characteristics of microorganisms • Relevant explanation of the main physiological mechanisms of microorganisms according to their specificities • Identification of the microorganisms present at the taxonomic level required by the research parameters 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use and demonstrate different staining techniques and biochemical assay methods. • Use and demonstrate the use of microscopes • Understand and use proper disinfection and safety rules and applications in the lab. • Properly identify microorganismal and colony morphology. • Understand and identify different taxonomic groups of microorganisms.
<p>Element 3: Count the different microorganisms.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of counting methods according to established standards • Formulation of accurate diagnostic impressions in relation to the defined research parameters 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate microorganism counting methods such as colony counting, MPN. • Analyze data and assess microbiological levels.
<p>Element 4: Explain the connections between these microorganisms and their respective habitats.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant explanation of the role of these microorganisms in their respective habitats • Accurate description of the factors influencing the relative abundance and diversity of these microorganisms • Forecast assessment of the impact of environmental changes on the microorganisms' ability to survive 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain the survival and environmental requirements of each group of microorganisms. • Distinguish different survival habits of microorganisms, like parasitism, mutualism, saprobism.
<p>Competency 044J: To culture and maintain organisms.</p>	
<p>Element 1 : Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate in the lab the importance of following protocols. • Work within the time allocated for a task. • Understand and use proper safety and handling protocols for microorganisms.

Element 2 : Perform tasks related to the culture, breeding and *in vitro* culture of organisms, as well as bioassays.

Performance Criteria

- Rigorous application of techniques and methods associated with the different types of tasks
- Appropriate use of the required means
- Ability to work independently in order to fine-tune the methods, techniques and protocols suited to the circumstances
- Effective resolution of all problems encountered during the work
- Accurate, ongoing determination of the indicators observed
- Accurate, precise interpretation of results in order to formulate a diagnostic impression of the condition of the environment

Learning Outcomes

Students will be able to:

- Demonstrate different techniques followed in microbiological work.
- Demonstrate his/her ability to accomplish a task independently and in a team.
- Analyze and interpret results of experiments and projects performed.

Course Title	Ecology
Course Code	101-311-VA
Competencies	<p>0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p> <p>044A: To use digital and computer technologies on the job.</p> <p>043W: To establish the profile of a situation using statistics.</p> <p>044E: To convey information about a natural environment.</p> <p>044H: To analyze how animals live and adapt to their environment.</p>
Ponderation	3-3-3
Credits	3
Prerequisites	
Links: <i>Backward</i>	Backward: 145-111-VA Outlook on the Environment, 420-706-VA Computer Skills, 101-211-VA Botany, 101-221-VA Vertebrate Form and Function 1, 201-234-VA Biometry
<i>Forward</i>	145-411-VA Ecological Research Techniques, 145-531-VA Limnology, 145-541-VA Fisheries Management, 145-551-VA Ornithology, 145-611-VA Mammal Management
<i>Current Semester</i>	101-321-VA Vertebrate Form and Function 2
Course Description	
<p>This course examines the relationship between organisms and their environment, including energy and nutrient pathways, population dynamics, communities, and biomes. Laboratories include field sampling and site visits.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> ▪ While conducting analyses including field work (when certain data provided must be validated) and the interpretation of thematic maps and aerial photographs ▪ For all work-related tasks ▪ Using applications related to word and image processing, data processing and the creation of databases ▪ For activities carried out in a natural environment: research, land-use planning, resource management, etc. ▪ Under the supervision of the project coordinator ▪ Based on raw or preprocessed data pertaining to the main aspects of the situation under study, a previously formulated working hypothesis and a general description of the situation ▪ Using the required tools, including appropriate software and any necessary documentation ▪ For purposes of interpretation and training, scientific popularization and the production of scientific materials, including technical reports and parts of research reports ▪ Based on specific requests and expressed or perceived information needs ▪ Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer equipment and any other appropriate apparatus <p>Working on research that involves characterizing biotic and abiotic resources in natural and controlled environments</p>	<ul style="list-style-type: none"> ▪ In the classroom <ul style="list-style-type: none"> - Lectures - Discussion - Textbook - Class notes ▪ In the lab <ul style="list-style-type: none"> - Data sampling - Data analysis of samples collected from the field and in the lab, using a spreadsheet ▪ In the field <ul style="list-style-type: none"> - Field trips (observation) - Field trips (sampling)

<ul style="list-style-type: none"> ▪ While conducting analyses related to organisms ▪ Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols ▪ Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases 	
<p>Competency 0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p>	
<p>Element 4: Explain how the physical components of an environment determine the living conditions of the organisms that inhabit it</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Description of the main abiotic ecological constraints inherent in the environment in terms of the living functions of the organisms that inhabit it 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Describe the effects of abiotic components of an environment on living organisms, ecosystem and biome composition , and productivity
<p>Competency 044A: To use digital and computer technologies on the job.</p>	
<p>Element 2: Use word-processing applications</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formatting of scientific documents • Importing and integration of various elements 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Write lab reports and a paper (literature survey) using accepted scientific format • Insert figures and tables in the documents • Use citations and references
<p>Element 3: Use computerized tools for statistical processing and data representation</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Design of relevant computerized worksheets useful for collecting and inputting data • Determination of a worksheet and file format adapted to the study parameters and their specific context • Validation of whether the worksheets are functional • Correct inputting of data provided • Use of basic functions related to the application's statistical processing • Use of basic functions related to the creation of pivot tables and the production of graphs 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Adapt a spreadsheet for analysis of ecological data • Input field and laboratory data into a spreadsheet • Use built-in functions • Use data and analysis to create pivot tables and graphs
<p>Competency 043W: To establish the profile of a situation using statistics.</p>	
<p>Element 1: Input data using a computer</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper use of appropriate applications, including formatting a spreadsheet • Complete, accurate data input 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Use a spreadsheet for data input and analysis • Adapt ecological functions for spreadsheet use
<p>Element 2: Validate the data provided</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of bias related to data collection • Accurate assessment of the degree of accuracy and relevance of the measurements provided 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Design basic sampling methods, including use of randomization

<ul style="list-style-type: none"> • Rejection of invalid and irrelevant data 	<ul style="list-style-type: none"> • Identify possible sources of bias (biotic and abiotic) and be able to minimize them
Element 3: Determine the type of statistical processing required	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct characterization of samples: types of samples, types of parameters and types of distributions • Selection of statistical operations and tests according to the type of data and the initial hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify variables • Choose analytical tools based on appropriate parameters
Element 4: Perform the statistical processing required	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of appropriate statistical functions • Selection of relevant variables • Proper execution of selected functions and accurate calculations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply statistical descriptors and tests to field and laboratory data • Identify variables for testing • Use spreadsheet functions where appropriate • Create spreadsheet formulas as necessary • Apply formulas to input data
Element 5: Format and present the data in graph form	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of the most appropriate form of graphic presentation • Quality of the tables: <ul style="list-style-type: none"> – relevance of data presented – consideration of appropriate parameters (format, organization and legibility to facilitate interpretation) • Quality of the figures: <ul style="list-style-type: none"> – presentation of highlights – conformity with presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Recognise the appropriate data presentation for a particular variable (table or graph, type of graph) • Choose which data points should be included • Choose the presentation appropriate for scientific format • Create tables and graphs of appropriate format
Element 6: Analyze and interpret the results obtained	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct definition of the different statistical concepts and terminology used • Accurate explanations regarding the statistical processing performed • Satisfactory degree of accuracy and significance meaning of the results presented • Accurate interpretation, given the initial problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain why descriptive statistics and test statistics were chosen • Explain the statistical principles • Explain the limitations of the techniques used • Interpret the results in terms of biological significance
Competency 044E: To convey scientific information.	
Element 1: Describe the different target audiences.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Thorough analysis of the target audience's needs and characteristics • Accurate establishment of the target audience profile 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe the various levels of presentation

Element 2: Determine the objectives, approach and content of the communications	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate, relevant objectives defined • Methodical, effective review of literature on the subject • Selection of content based on relevance to objectives pursued • Determination of a communication approach and strategies adapted to these specific aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Carry out a review of scientific literature on a chosen ecological topic
Element 3: Plan and organize the content of the communications	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Validation of the accuracy of the content with the qualified authorities • Strategic selection of communication means and media • Content and format of materials organized in order to communicate appropriate educational and strategic information 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Analyse the quality and reliability of the information gathered in a literature review (internet, magazines, books, peer-review journals) • Analyse the importance of various information gathered as it relates to the original topic
Element 4: Produce all the elements required for the communications	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Quality of the different communication elements produced: texts, images, tables, presentations • Appropriate popularization of the content of the communications • Use of terminology and language adapted to the target audience • General quality of the language and organization of the different communication elements • Consideration of applicable presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Synthesize and arrange information on a topic • Determine the level of technical presentation
Element 5: Present the content of the communications	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct application of rules and principles pertaining to oral and written communication as well as communication intended for the media • Appropriate use of the different media • Consideration of different communication styles in their dealings with the target audience • General quality of the communications: coherence, clarity, accurate language 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Write in the appropriate style (general discussion, technical discussion, etc.) • Use computer software to prepare the information and add appropriate tables and figures • Use technical terminology
Competency 044H: To analyze how animals live in and adapt to their environment	
Element 2: Explain the connections between the characteristics of animals and their respective habitats	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant explanation of the role of animals in their respective habitats • Forecast assessment of the impact of environmental changes on the animals' ability to adapt and survive 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe limiting factors • Describe and analyse population parameters such as density, distribution, mortality, natality, growth rate and type, life tables, etc. • Describe species interactions such as predation, mutualism • Describe and draw biogeochemical cycles and

	<p>explain their effect on animals</p> <ul style="list-style-type: none">• Describe trophic levels, energy flow through the grazing and decomposer food chains• Relate abiotic factors to biome type and types of animals in that biome
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Course Title	Vertebrate Form and Function 2	
Course Code	101-321-VA	
Competencies	<p>0449: To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p> <p>044E: To convey information about a natural environment.</p> <p>044H: To analyze how animals live and adapt to their environment.</p> <p>044J: To culture and maintain organisms.</p> <p>044U: To apply scientific approach to problem-solving in a natural environment.</p>	
Ponderation	3-2-3	
Credits	2 2/3	
Prerequisites		
Links: Backward	101-221-VA Vertebrate Form and Function 1	
Forward	Forward: 145-541-VA Fisheries Management, 145-611-VA Mammal Management	
Current Semester	101-311-VA Ecology, 145-311-VA Vertebrate Taxonomy	
Course Description		
<p>This is the first of a two-course series on vertebrate anatomy (study of form) and physiology (study of function). This course will explore the following vertebrate body systems: support, protection and movement; nervous coordination; digestion and basic nutrition; and chemical coordination.</p>		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
<ul style="list-style-type: none"> • Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer equipment and any other appropriate apparatus • While conducting analyses related to organisms • Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols • Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases • Working alone or in a team, with supervision and complying with all ethical considerations • Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input • Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects • For research conducted alone, under supervision and in the field and in a lab • Based on concrete study, analysis and intervention situations where problems require that lab protocols and methods be adjusted or modified or that practices for intervening in the natural environment be modified according to specific conditions and constraints 		<ul style="list-style-type: none"> • In class: <ul style="list-style-type: none"> - Lectures - Directed reading assignments - Discussions • In lab: <ul style="list-style-type: none"> - laboratory manual - Reference texts - Histology - Animal dissection - Experiments on the respiratory, cardiovascular, and urinary systems

<ul style="list-style-type: none"> Using the required scientific and technical documentation, tools, computer applications, equipment, apparatus and products 	
<p>Competency 0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p>	
<p>Element 4 : Explain how the physical components of an environment determine the living conditions of the organisms that inhabit it.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Description of the main abiotic ecological constraints inherent in the environment in terms of the living functions of the organisms that inhabit it Explanation of the main mechanisms by which organisms adapt their anatomy, physiology and morphology to environmental requirements 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> List biological constraints of an environment for organisms inhabiting an environment. Describe how organisms adapt to meet environmental requirements.
<p>Competency 044E: To convey scientific information.</p>	
<p>Element 2: Determine the objectives, approach and content of the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Accurate, relevant objectives defined Methodical, effective review of literature on the subject Selection of content based on relevance to objectives pursued 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> Understand how to prepare a laboratory report including introduction, materials and methods, results, conclusion and reference list. Prepare result tables and figures.
<p>• Element 3: Plan and organize the content of the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Validation of the accuracy of the content with the qualified authorities Strategic selection of communication means and media Content and format of materials organized in order to communicate appropriate educational and strategic information 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> Validate data recorded. Present data in an organized manner.
<p>Element 4: Produce all the elements required for the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Quality of the different communication elements produced: texts, images, tables, presentations Appropriate popularization of the content of the communications Use of terminology and language adapted to the target audience General quality of the language and organization of the different communication elements Consideration of applicable presentation standards 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> Prepare laboratory report. Prepare figures and tables. Use proper terminology in writing a laboratory report. Apply standards in preparing a laboratory report.
<p>Element 5: Present the content of the communications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Consideration of different communication styles in their dealings with the target audience General quality of the communications: coherence, clarity, accurate language 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> Communicate clearly and coherently.
<p>Element 6: Evaluate the effectiveness of the communication in order to make improvements.</p>	
<p><u>Performance Criteria</u></p>	<p><u>Learning Outcomes</u></p>

<ul style="list-style-type: none"> • Strategic evaluation of the achievement of initial objectives • Identification of elements that could be improved • Accurate modification of the different elements based on the weaknesses observed 	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Evaluate initial objectives of lab experiment. • Identify elements needing improvement in laboratory report. • State modifications for improving laboratory report.
<p>Competency 044H: To analyze how animals live and adapt to their environment.</p>	
<p>Element 2: Explain the connections between the characteristics of animals and their respective habitats.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant explanation of the main physiological mechanisms of animals according to their specificities • Relevant explanation of the role of animals in their respective habitats • Forecast assessment of the impact of environmental changes on the animals' ability to adapt and survive 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain how animals function in their environment. • Explain the coordinating systems, support, protection and movement systems, and the digestive systems of vertebrates. • Forecast how animals will adapt to their environment.
<p>Competency 044J: To culture and maintain organisms.</p>	
<p>Element 1: Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Determine cultural needs of the organism. • Determine equipment and environmental conditions required to meet the needs of the organism. • Plan an experiment which respects the needs of the organism and the goal of the experiment while recognising limitations of time and resources.
<p>Element 2: Perform tasks related to the culture, breeding and <i>in vitro</i> culture of organisms, as well as bioassays.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of techniques and methods associated with the different types of tasks • Appropriate use of the required means • Ability to work independently in order to fine-tune the methods, techniques and protocols suited to the circumstances • Effective resolution of all problems encountered during the work • Accurate, ongoing determination of the indicators observed • Accurate, precise interpretation of results in order to formulate a diagnostic impression of the condition of the environment • Rigorous application of the asepsis measures required for <i>in vitro</i> culture 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Culture and maintain organisms • Perform bioassays • Interpret results obtained • Apply appropriate measures

Element 5: Keep a technical log.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of materials and products used as well as the organisms studied • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> – methodology – work context and conditions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • List materials and products used during the experimentation. • List the organisms under study. • Record relevant information on methods, work context and conditions.
Competency 044U: To apply scientific approach to problem-solving.	
Element 2: Formulate a hypothesis regarding the causes of the problem.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant hypothesis put forth • Theoretical validation of the hypothesis put forth in terms of the current knowledge on the subject • Determination of the type of approach to take • <i>A priori</i> determination of the expected results and the degrees of confirmation of the hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Write a relevant hypothesis • Validate hypothesis using theory • Determine expected results
Element 3: Plan the research process.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous determination of how the work should proceed: <ul style="list-style-type: none"> – nature of parameters and data – methodological elements and corresponding steps – procedures for inputting and processing data • Determination of the required resources • Effective organization of how and where the work should take place • Consideration of all health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Plan the scientific project. <ul style="list-style-type: none"> - Define scope and goals - Determine procedures to meet goals - Determine “Materials and Methods” phase of the project - Plan in accordance with health and safety guidelines, potential hazards
Element 4: Apply the chosen methodology.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of protocol • Adequate use of the techniques associated with different operations • Complete, accurate data collected • Appropriate processing of data 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply the chosen methodology. <ul style="list-style-type: none"> - Follow the standard operating procedures (SOPs) - Collect data in proper format - Process data according to the protocol
Element 5: Analyze the results obtained in order to confirm or reject the hypothesis.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Detailed review of the application of the process in order to confirm that the data obtained is reliable • Identification of the main sources of errors and bias that could interfere with the quality of results and their interpretation 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Analyse results obtained. • Confirm or reject the hypothesis. • Explain the results obtained.

<ul style="list-style-type: none"> • Systematic comparison of actual and expected results • Relevant conclusions regarding the initial hypothesis 	
<p>Element 6: Write a technical report.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete report in conformity with the standards in effect for scientific presentation: <ul style="list-style-type: none"> – description of the initial problem – description of the methodology – data and results obtained – analysis of results and ensuing conclusions • Formulation of relevant recommendations: <ul style="list-style-type: none"> – generalization of the solution if the hypothesis is confirmed – formulation of a new hypothesis if the hypothesis is rejected 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Write a full laboratory report, including the following sections: introduction, material and methods, results, conclusion and recommendations and literature cited. • Formulate a new hypothesis if the current one was rejected.

Course Title	Invertebrate Zoology
Course Code	101-411-VA
Competencies	044H: To analyze how animals live in and adapt to their environment.
Ponderation	3-2-1
Credits	2
Prerequisites	
Links: Backward	101-111-VA Cell Biology
Forward	145-521-VA Entomology, 145-541-VA Fisheries Management
Current Semester	None
<p>Course Description This course acquaints the student with the structure, evolution, and relationships of the major invertebrate groups. It introduces the principal anatomical and morphological characteristics and appropriate terminology for the proper identification of invertebrates. Principles of classification, taxonomy, and cataloguing are used for invertebrate classification, especially those invertebrates which have an important impact on economically important species. Special emphasis is given to those groups found in Quebec, including techniques for preparation of an insect collection.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> Working on research that involves characterizing biotic and abiotic resources in natural and controlled environments while conducting analyses related to organisms Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases 	<p><u>In the classroom</u></p> <ul style="list-style-type: none"> lectures discussion textbook class notes <p><u>In the lab</u></p> <ul style="list-style-type: none"> use of microscope lab manual lab exams
Competency 044H: To analyze how animals live in and adapt to their environment.	
Element 1: Characterize the animals in order to identify them.	
Performance Criteria	Learning Outcomes
<ul style="list-style-type: none"> Rigorous application of the techniques and methods associated with identifying specimens Proper use of apparatus associated with identifying animals Accurate description of the anatomical and morphological characteristics of animals Identification of animals at the taxonomic level required by the research parameters 	<p>Students will be able to:</p> <ul style="list-style-type: none"> Use taxonomic keys and field guides to identify both aquatic and terrestrial insects to family level. Practice the proper handling, maintenance, and use of dissecting microscopes. Review all taxonomic keys and field guides. Identify the family of insects, by working in pairs in the lab.

Course Title	Outlook on the Environment	
Course Code	145-111-VA	
Competencies	0448 : To analyze the occupation. 0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it. 044B: To describe the abiotic components of a natural environment 044E: To convey scientific information 044N: To apply health and safety measures. 044P: To apply wilderness survival techniques.	
Ponderation	3-2-2	
Credits	2 1/3	
Prerequisites		
Links: Backward	NA	
Forward	101-311-VA Ecology, 202-311-VA Solution Chemistry, 145-561-VA Ecotoxicology, 145-661-VA Environmental G.I.S.	
Current Semester	420-706-VA Computer Skills, 202-111-VA General Chemistry	
Course Description The student will be introduced to professional information (job searching techniques, communication and professional ethics), basic working tools and techniques (prepare lab reports, introduction to geographical information systems) and health and safety (team-building and a swim test). This will be integrated into a look at physical components of a natural environment: the lithosphere, the atmosphere, the hydrosphere and how they interact. The physical and chemical properties of soil, water and air, and their relationship to the maintenance of life will be studied.		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
<ul style="list-style-type: none"> • Using recent information on the occupation and the different work environments • During visits to companies as part of a job-search process • While conducting watershed analyses in an ecological time scale • Based on all the soil, sediment and water samples provided, meteorological data and a minimal description of the organisms found • Using appropriate documentation: classification keys pertaining to soil, sediment and surface deposit studies; data sheets; thematic maps (all types of maps used in the field) and aerial photographs • For all types of research involving ecosystem characterization • Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a predetermined budget as well as predetermined formats for data input • Analyzing samples taken in the field or in the lab • Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects • For purposes of interpretation and training, scientific popularization and the production of scientific materials, including technical reports and parts of research reports • Based on specific requests and expressed or perceived information needs • Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer equipment and any other appropriate apparatus • In an emergency situation and in extreme conditions 		<ul style="list-style-type: none"> • In class <ul style="list-style-type: none"> - Lectures - Directed reading assignments - Discussions - Guest speakers • In lab <ul style="list-style-type: none"> - Basic geology - Basic analysis of air - Basic analysis of water - Analysis of soils - Applications of GIS - Applications of word processing • In field <ul style="list-style-type: none"> - Examination and analysis of local geomorphology, including slope, hydrology, and glaciation • In gym <ul style="list-style-type: none"> - Testing swimming abilities - Perform canoe rescue • Visits to industry

<ul style="list-style-type: none"> Using basic survival materials and a basic first-aid kit 	
Competency 0448: To analyze the occupation.	
Element 1 : Describe the occupation and the conditions under which it is practised.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Relevant information gathered Thorough analysis of the general characteristics of the occupation and the conditions for practising the occupation Identification of the different work environments Identification of the different career options 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Collect necessary information on the occupation Identify the occupation and the conditions for practising it Examine different work environments List different careers options.
Element 2 : Analyze the tasks and operations related to the occupation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Appropriate analysis of the tasks and operations, the conditions under which they are carried out and the criteria associated with each of them Accurate assessment of the relative importance of each task Relationship established between the steps in the work process and the occupational tasks 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> Explain tasks and operations related to the occupation Compare between different tasks Integrate the steps in the work process and the occupational tasks
Element 3 : Analyze the skills and behaviours required to practise the occupation	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Relevant connections between skills and behaviours, on the one hand, and the occupational tasks, on the other Identification of professional rules of ethics 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> Understand skills, behaviours and tasks and correctly associate them Identify professional rules of ethics
Element 4 : Analyze the requirements associated with entrepreneurship	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Identification of self-employment opportunities in the sector Appropriate analysis of strategies for preparing an offer of professional services Analysis of requirements, constraints and resources related to starting up a business in this sector 	<p><u>Learning Outcomes</u></p> <p>Student will be able to :</p> <ul style="list-style-type: none"> Prepare to become self-employed in this sector Prepare an offer of professional services, Prepare a résumé Identify resources needed to start a business in this sector.
Competency 0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.	
Element 1 : Describe the relief of a watershed or ocean basin	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Accurate interpretation of different thematic maps and aerial photographs Delineation of the watershed or ocean basin and description of its geomorphologic aspects Determination of the main erosive factors explaining the formation of the relief 	<p><u>Learning Outcomes</u></p> <p>Student will be able to :</p> <ul style="list-style-type: none"> Use and interpret soil maps, topographic maps, and stereoscopic maps Identify a geographical information system Apply thematic maps Use topographic maps and stereo-photos to delineate watersheds Describe the principle erosive factors responsible for the formation of topographic relief
Element 2 : Analyze the factors that influence the main characteristics of the soils and sediments of a watershed or ocean basin	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Accurate description of the components of the different types of soils, sediments and surface deposits Accurate description of the physical, physicochemical and biological properties of soils and sediments Relevant summary of the pedogenesis of soils, 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> Characterize and identify the origin of mineral and organic components of soil Describe texture and organic content of soils and explain the relevance of these factors to drainage, water-holding capacity, nutrient-holding capacity, and cation exchange capacity.

<p>sediments and surface deposits</p> <ul style="list-style-type: none"> • Explanation of the influence of the geology, geomorphology, hydrology and climate of the environment on the properties of soils, sediments and surface deposits 	<ul style="list-style-type: none"> • Describe the origin of sediments and surface deposits through the action of the freeze-thaw cycle, running water, wind, and continental glaciation. • Explain the role of parent material, the influence of moisture and standing water, as well as climate in pedogenesis
<p>Element 4 : Explain how the physical components of an environment determine the living conditions of the organisms that inhabit it</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Description of the main abiotic ecological constraints inherent in the environment in terms of the living functions of the organisms that inhabit it • Explanation of the main mechanisms by which organisms adapt their anatomy, physiology and morphology to environmental requirements 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> • Understand influence of air, water and soil in living conditions of the organisms that inhabit an area • Describe the links between abiotic factors and living organisms • Explain the basic adaptations of organisms to their environment
<p>Competency 044N: To apply health and safety measures.</p>	
<p>Element 1 : Recognize the potential risks in a lab and in the field</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate distinction of the different types of risks: <ul style="list-style-type: none"> – environmental factors – factors related to the types of tasks, including handling and containing a variety of organisms – factors related to the use of products, apparatus and equipment – factors related to attitudes and general behaviours • Careful observation and accurate interpretation of signs of potential danger • Realistic assessment of the degree of danger involved in various risky situations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Understand the environment and its risks • Observe laboratory policy • Apply safe practices in the laboratory • Assess dangers in laboratory
<p>Element 2 : Apply the necessary health and safety preventive measures</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate understanding of the site evacuation plan • Accurate location of equipment and identification of resource persons in the event of an emergency • Verification that all health and safety materials are accessible and in good working order • Development of materials according to the weaknesses observed • Adoption of safe behaviours and attitudes in all circumstances • Rigorous application of preventive measures with respect to: <ul style="list-style-type: none"> – handling organisms – using hazardous products using equipment 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply the evacuation plan • Locate health and safety equipment • Identify resource people • Verify that health and safety materials are in working order. • Safely handle organisms and hazardous equipment
<p>Element 3 : Take action in an emergency or in the event of an accident on the work site</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Full knowledge of their obligations and responsibilities • Application of emergency measures with level headedness and according to established procedures 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Understand his obligations and responsibilities • Apply emergency measures accordingly
<p>Competency 044B: To describe the abiotic components of a natural environment</p>	

Element 2: Take samples.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Adequate use of techniques for sampling water, soils and sediments • Respect defined protocols • Optimal accuracy and quality of samples • Appropriate conservation of samples 	Students will be able to : <ul style="list-style-type: none"> • Respect defined protocol • Sample soil • Collect, label, conserve samples • Sample water
Element 3: Analyze the samples.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Analysis of all the physical and physicochemical parameters required • Rigorous use of analysis instruments in compliance with prescribed techniques • Good tactile and visual sensitivity 	Students will be able to : <ul style="list-style-type: none"> • Analyze soil and water characteristics • Use analysis instruments • Handle samples correctly • Observe while respecting techniques at hand
Element 4: Take the necessary measurements.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Measurement of all physical and physicochemical parameters required • Rigorous use of measuring instruments in compliance with prescribed techniques • Optimal accuracy and quality of measurements according to established protocols 	Students will be able to : <ul style="list-style-type: none"> • Measure physical and physicochemical parameters • Use measuring instruments rigorously • Ensure instruments are used optimally
Element 5: Compile all the data.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Complete, correct inputting of data on worksheets • Regular, methodical verification to ensure that data is valid and complete 	Students will be able to : <ul style="list-style-type: none"> • Collect data • Input data onto worksheets • Work methodically • Verify for completeness of data
Element 6: Keep a technical log.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Complete list of the materials and products used • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> – methodology – work context and conditions 	Students will be able to : <ul style="list-style-type: none"> • Identify necessary instruments • Identify sampling operations • Prepare a log of operations • Clearly note all events and observations under study
Element 7: Analyze and interpret the data.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Establishment of a summary portrait of the physical environment and its components • Formulation of a plausible hypothesis on the quality of the environment in terms of the needs of the organisms that inhabit it 	Students will be able to : <ul style="list-style-type: none"> • Integrate data into a portrait of the physical environment • Demonstrate the quality of the environment by inferring to the soil characteristics present
Competency 044E: To convey scientific information	
Element 1: Describe the different target audiences.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Thorough analysis of the target audience's needs and characteristics • Accurate establishment of the target audience profile 	Students will be able to : <ul style="list-style-type: none"> • Identify target audience
Element 2: Determine the objectives, approach and content of the communications.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> • Accurate, relevant objectives defined 	Students will be able to :

<ul style="list-style-type: none"> • Methodical, effective review of literature on the subject • Selection of content based on relevance to objectives pursued • Determination of a communication approach and strategies adapted to these specific aspects 	<ul style="list-style-type: none"> • Define objectives of a communication activity • Prepare a thorough literature review on a subject • Define a strategy for communicating a subject
Element 3: Plan and organize the content of the communications.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Validation of the accuracy of the content with the qualified authorities • Strategic selection of communication means and media • Content and format of materials organized in order to communicate appropriate educational and strategic information 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> • Contact relevant parties • Select proper mean of communication
Element 4: Produce all the elements required for the communications.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Quality of the different communication elements produced: texts, images, tables, presentations • Appropriate popularization of the content of the communications • Use of terminology and language adapted to the target audience • General quality of the language and organization of the different communication elements • Consideration of applicable presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> • Produce a communication effort that includes text, images, tables, etc. • Ensure information is properly communicated to target audience
Element 5: Present the content of the communications.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct application of rules and principles pertaining to oral and written communication as well as communication intended for the media • Appropriate use of the different media • Consideration of different communication styles in their dealings with the target audience • General quality of the communications: coherence, clarity, accurate language 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> • Apply principles of oral and written communication • Prepare information for use by media • Communicate an idea
Element 6: Evaluate the effectiveness of the communication in order to make improvements.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Strategic evaluation of the achievement of initial objectives • Identification of elements that could be improved • Accurate modification of the different elements based on the weaknesses observed 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> • Evaluate achievement of initial objectives • Identify elements that could be improved • Provide modifications of weaknesses observed
Competency 044P: To apply wilderness survival techniques.	
Element 1: Participate in preliminary tasks leading to the development of an action plan.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous analysis of the problem, its nature, and the objectives and issues related to the project • Active participation in determining the goals, objectives and action strategies • Active participation in establishing priorities, a timetable and the sharing of responsibilities • Determination, as a team, of the indicators for monitoring and evaluating the tasks 	<p><u>Learning Outcomes</u></p> <p>Students will be able to :</p> <ul style="list-style-type: none"> • Demonstrate adequate swimming skills in a swim test • Identify weaknesses in swimming • Apply canoe rescue techniques

Course Title	Vertebrate Taxonomy
Course Code	145-311-VA
Competencies	044H: To analyze how animals live in and adapt to their environment. 044J: To culture and maintain organisms 044R: To describe the biotic components of a terrestrial environment.
Ponderation	2-3-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-221-VA Vertebrate Form and Function 1
Forward	Forward: 541-VA Fisheries Management, 145-551-VA Ornithology, 145-611-VA Mammal Management
Current Semester	101-321-VA Vertebrate Form and Function 2
Course Description This course covers the anatomy of fish, amphibians, reptiles, birds and mammals with particular emphasis on those features used in taxonomic keys and field guides. By using these keys and field guides, the student will learn how to identify any vertebrate of Quebec to species. During field work, the student will be introduced to the habitats in which many of the species are typically found.	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> Working on research that involves characterizing biotic and abiotic resources in natural and controlled environments While conducting analyses related to organisms Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases For all types of research focusing primarily on ecosystem characterization, including conservation and restoration While performing tasks related to culture and breeding, bioassays, <i>in vitro</i> culture and the conservation of scientific collections Working alone or in a team, with supervision and complying with all ethical considerations Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects 	<ul style="list-style-type: none"> In class <ul style="list-style-type: none"> lectures handouts text reference texts primary literature discussion In lab <ul style="list-style-type: none"> taxonomic keys and field guides preserved fish bird study skins mammal study skins and skulls In the field <ul style="list-style-type: none"> systematic searches of terrestrial and aquatic habitats near the field station to collect and identify amphibians and reptiles to species live trapping in different terrestrial habitats to collect, identify, sex, and age small mammals to species.
Competency 044H: To analyze how animals live in and adapt to their environment.	
Element 1: Characterize the animals in order to identify them	
Performance Criteria	Learning Outcomes
<ul style="list-style-type: none"> Rigorous application of the techniques and 	Students will be able to:

<p>methods associated with identifying specimens</p> <ul style="list-style-type: none"> • Proper use of apparatus associated with identifying animals • Accurate description of the anatomical and morphological characteristics of animals • Identification of animals at the taxonomic level required by the research parameters 	<ul style="list-style-type: none"> • Use taxonomic keys and field guides to identify fish, amphibians, reptiles, birds, and mammals native found in Quebec to species. • Handle, maintain, and use dissecting microscopes and light sources. • Describe and identify all taxonomically relevant structures used in taxonomic keys and field guides. • Identify to species all vertebrates in the Quebec region.
<p>Competency 044J: to culture and maintain organisms.</p>	
<p>Element 1: Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Design animal facility protocols based on specific requirements of species to be cultured and maintained. • Establish physical requirements (space per individual, bedding, temperature, humidity, lighting, feeding and watering requirements) of species to be cultured and maintained, and design a regime to satisfy these. • Establish a scale of operation that can respect the requirements of 1.1, and 1.2 above within the budget constraints. • Establish the level of technical/animal care support required by 1.1, 1.2, and 1.3 above within the context of the project deadlines. • Establish any potential health hazards from the organisms (potential for physical injury or zoonotics carried by the organisms) as well as any health and safety issues associated with the protocols developed and post these before the project begins.
<p>Competency 044R: To describe the biotic components of a terrestrial environment.</p>	
<p>Element 2: Take inventories.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of inventory methods • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Accuracy and quality of information gathered, in particular with respect to: <ul style="list-style-type: none"> – identifying the species present – counting the species present – delineating the distribution areas of the species present 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe the standard inventory techniques used for the species under investigation. • Carry out these techniques properly following accepted protocols. • Adapt the inventory techniques to as such physical factors such as terrain, weather and biotic conditions dictate. • With the help of a taxonomic key, identify the species present, accurately record numbers, and establish and record distribution of the species present.

Course Title	Ecological Research Techniques	
Course Code	145-411-VA	
Competencies	0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it. 044A: To use digital and computer technologies on the job. 043W: To establish the profile of a situation using statistics. 044U: To apply scientific approach to problem-solving in a natural environment.	
Ponderation	2-3-3	
Credits	2 2/3	
Prerequisites		
Links: Backward	101-311-VA Ecology,	
Forward		
Current Semester		
Course Description		
<p>This course will continue to examine ecological issues relevant to Canada, such as boreal ecology. Research techniques in ecology will be discussed, and students will carry out a small research project at a basic level. CCAC guidelines for culture of animals will be reviewed, and animal husbandry of demonstration animals will be practised.</p>		
ACHIEVEMENT CONTEXT	LEARNING CONTEXT	
<ul style="list-style-type: none"> • Using applications related to word and image processing, data processing and the creation of databases • Under the supervision of the project coordinator • Based on raw or preprocessed data pertaining to the main aspects of the situation under study, a previously formulated working hypothesis and a general description of the situation • Using the required tools, including appropriate software and any necessary documentation • Working alone on research that involves characterizing biotic and abiotic resources in natural and controlled environments • While conducting analyses related to organisms • Based on live or dead specimens and samples; specimens that have been given to or collected by the technician or that derive from a natural environment; information on the environment and the living conditions of fungi and plants; as well as established or standardized research protocols • Using the required apparatus, lab tests, documentation, procedures and databases • For research conducted alone, under supervision and in the field and in a lab • Based on concrete study, analysis and intervention situations where problems require that lab protocols and methods be adjusted or modified or that practices for intervening in the natural environment be modified according to specific conditions and constraints • Taking into consideration predetermined time and budget constraints • Using the required scientific and technical documentation, tools, computer applications, equipment, apparatus and products 	<ul style="list-style-type: none"> • In the classroom: <ul style="list-style-type: none"> - Lectures - Discussion - Textbook - Class notes • In the lab: <ul style="list-style-type: none"> - Data sampling - Data analysis using a spreadsheet - Culture of organisms - Individual Project • In the field: <ul style="list-style-type: none"> - Field trips (observation) 	
Competency 0449 : To analyze the dynamics of the physical components of a natural environment and the		

organisms that inhabit it.	
Element 4: Explain how the physical components of an environment determine the living conditions of the organisms that inhabit it	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Description of the main abiotic ecological constraints inherent in the environment in terms of the living functions of the organisms that inhabit it • Explanation of the main mechanisms by which organisms adapt their anatomy, physiology and morphology to environmental requirements 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use established guidelines to design proper culture conditions for laboratory culture.
Competency 044A: To use digital and computer technologies on the job.	
Element 3: Use computerized tools for statistical processing and data representation	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Design of relevant computerized worksheets useful for collecting and inputting data • Determination of a worksheet and file format adapted to the study parameters and their specific context • Validation of whether the worksheets are functional • Correct inputting of data provided • Use of basic functions related to the application's statistical processing • Use of basic functions related to the creation of pivot tables and the production of graphs • Correct transfer of data to a database • Formulation of queries in order to use the database 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Adapt a spreadsheet for analysis of ecological data. • Input field and laboratory data into a spreadsheet • Use built-in functions. • Use data and analysis to create pivot tables and graphs.
Competency 043W: To establish the profile of a situation using statistics.	
Element 1: Input data using a computer	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper use of appropriate applications, including formatting a spreadsheet • Complete, accurate data input 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use a spreadsheet for data input and analysis. • Adapt ecological functions for spreadsheet use.
Element 2: Validate the data provided	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of bias related to data collection • Accurate assessment of the degree of accuracy and relevance of the measurements provided • Rejection of invalid and irrelevant data 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Design basic sampling methods, including use of randomization. • Identify possible sources of bias (biotic and abiotic) and be able to minimize them.
Element 3: Determine the type of statistical processing required	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct characterization of samples: types of samples, types of parameters and types of distributions • Selection of statistical operations and tests according to the type of data and the initial hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify variables. • Chose analytical tools based on appropriate parameters.
Element 4: Perform the statistical processing required	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>

<ul style="list-style-type: none"> • Selection of appropriate statistical functions • Selection of relevant variables • Proper execution of selected functions and accurate calculations 	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply statistical descriptors and tests to field and laboratory data. • Identify variables for testing. • Use spreadsheet functions where appropriate. • Create spreadsheet formulas as necessary. • Apply formulas to input data.
<p>Element 5: Format and present the data in graph form</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of the most appropriate form of graphic presentation • Quality of the tables: <ul style="list-style-type: none"> – relevance of data presented – consideration of appropriate parameters (format, organization and legibility to facilitate interpretation) • Quality of the figures: <ul style="list-style-type: none"> – presentation of highlights – conformity with presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Recognise the appropriate data presentation for a particular variable (table or graph, type of graph). • Choose which data points should be included. • Choose the presentation appropriate for scientific format. • Create tables and graphs of appropriate format.
<p>Element 6: Analyze and interpret the results obtained</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct definition of the different statistical concepts and terminology used • Accurate explanations regarding the statistical processing performed • Satisfactory degree of accuracy and significance meaning of the results presented • Accurate interpretation, given the initial problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain why descriptive statistics and test statistics were chosen. • Explain the statistical principles. • Explain the limitations of the techniques used. • Interpret the results in terms of biological significance.
<p>Competency 044U: To apply scientific approach to problem-solving in a natural environment.</p>	
<p>Element 1: Define the problem</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate interpretation of the clues observed • Relevant, clear questions formulated • Accurate description of the nature and scope of the problem • Clear, accurate statement of the problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Discuss within a group the goals and objectives of the study, based on theory and observed data. • Define with precision the parameters to be measured.
<p>Element 2: Formulate a hypothesis regarding the causes of the problem</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant hypothesis put forth • Theoretical validation of the hypothesis put forth in terms of the current knowledge on the subject • Determination of the type of approach to take • <i>A priori</i> determination of the expected results and the degrees of confirmation of the hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Research the various techniques applicable to the project. • Examine the advantages/disadvantages of alternative techniques available to meet the goals and objectives.
<p>Element 3: Plan the research process</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous determination of how the work should proceed: <ul style="list-style-type: none"> – nature of parameters and data – methodological elements and corresponding steps – procedures for inputting and processing data • Determination of the required resources • Effective organization of how and where the work 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • As part of a group, discuss and choose the best techniques with respect to the limitations of the laboratory facilities, equipment, time, and budget. • Follow all norms for safe laboratory operations.

<p>should take place</p> <ul style="list-style-type: none"> • Consideration of all health and safety aspects 	
Element 4: Apply the chosen methodology	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of protocol • Adequate use of the techniques associated with different operations • Complete, accurate data collected • Appropriate processing of data 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply the research protocol. • Complete data sheets. • Synthesize data through computer tabulation.
Element 5: Analyze the results obtained in order to confirm or reject the hypothesis	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Detailed review of the application of the process in order to confirm that the data obtained is reliable • Identification of the main sources of errors and bias that could interfere with the quality of results and their interpretation • Systematic comparison of actual and expected results • Relevant conclusions regarding the initial hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify potential sources of error in data collection. • Evaluate data for validity. • Summarize the conclusions.
Element 6: Write a technical report	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete report in conformity with the standards in effect for scientific presentation: <ul style="list-style-type: none"> – description of the initial problem – description of the methodology – data and results obtained – analysis of results and ensuing conclusions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Prepare a technical report in conformity with the scientific format, based on an appropriate style guide.

Course Title	Laboratory Techniques & Instrumentation	
Course Code	145-421-VA	
Competencies	044C: To carry out laboratory analyses. 044N: To apply health & safety measures	
Ponderation	2-3-1	
Credits	2	
Prerequisites		
Links: Backward		
<i>Forward</i>		
<i>Current Semester</i>		
Course Description This course provides a review of the equipment and manipulation associated with various laboratory techniques such as weighing, filtration, ignition, separation etc. The course also deals with the instruments and the techniques necessary for sampling and analysis in both the laboratory and the field.		
ACHIEVEMENT CONTEXT	LEARNING CONTEXT	
<ul style="list-style-type: none"> • For all types of research focusing primarily on ecosystem characterization, including conservation and restoration • While conducting biochemical, physicochemical and genetic analyses • Working generally alone, with supervision and complying with all ethical considerations • Based on defined or standardized research methods and protocols, in particular, gravimetric and non-gravimetric separation, microscopy, photometry, electrochemistry; provided soil, water and organism samples and all related relevant information; a predetermined deadline and budget as well as predetermined formats for data input • Using the required procedures documentation, apparatus, instruments and tools as well as all the means related to logistical aspects • For all types of activities performed in a natural environment and in a lab • Using the required documentation • Using the required materials: first-aid kit, protective clothing and equipment, and health and safety facilities 	<ul style="list-style-type: none"> • In the classroom <ul style="list-style-type: none"> -Lectures -Class notes • In the lab <ul style="list-style-type: none"> -Calibration and proper use of laboratory and field instruments • In the field <ul style="list-style-type: none"> -Field trips – sampling 	
Competency 044C: To carry out laboratory analyses.		
Element 1: Plan the work under their responsibility.		
Performance Criteria <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	Learning Outcomes Students will be able to: <ul style="list-style-type: none"> • List all the steps to be followed. • Estimate time for each task. • List all the physical and chemical agents to be used and verified if safer and less expensive alternatives can be used. • Follow the health and safety aspects of physical and chemical agents to be used and their health and safety aspects verified using the appropriate MSDS (Material Safety Data Sheet). 	
Element 2: Perform the preliminary work required for the analyses.		

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper assembly, adaptation and calibration of equipment • Accurate calculations for the dilution and concentration of solutions • Accurate conversions of concentration units • Methodical preparation of solutions, using volumetric instruments and the required materials • Preparation and preprocessing of samples according to the types of analysis required 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Assemble and calibrate equipment. • Calculate solution concentrations and prepare dilute solutions using stock solutions. • Relate various concentration units such as molarity, ppm, % etc. • Process samples.
<p>Competency 044N: To apply health and safety measures.</p>	
<p>Element 1 : Recognize the potential risks in a lab and in the field.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate distinction of the different types of risks: <ul style="list-style-type: none"> – environmental factors – factors related to the types of tasks, including handling and containing a variety of organisms – factors related to the use of products, apparatus and equipment – factors related to attitudes and general behaviours • Careful observation and accurate interpretation of signs of potential danger • Realistic assessment of the degree of danger involved in various risky situations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify sources of chemical, biological and physical hazards. • Apply preventive measures used in a laboratory environment. • Implement WHMIS (Workplace Hazardous Material Information System) . • Interpret MSDS (Material Safety Data Sheet).
<p>Element 2 : Apply the necessary health and safety preventive measures.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate understanding of the site evacuation plan • Accurate location of equipment and identification of resource persons in the event of an emergency • Verification that all health and safety materials are accessible and in good working order • Development of materials according to the weaknesses observed • Adoption of safe behaviours and attitudes in all circumstances • Rigorous application of preventive measures with respect to: <ul style="list-style-type: none"> – handling organisms – using hazardous products – using equipment 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Locate the safety equipment and materials. • Follow college wide emergency plans in case of fire or other emergencies. • Observe rules of laboratory conduct. • Consult appropriate MSDS (Material Safety Data Sheet) before handling hazardous materials.

Course Title	Bioremediation & Waste Management	
Course Code	145-431-VA	
Competencies	044B: To describe the abiotic components of a natural environment. 044C: To carry out laboratory analyses.	
Ponderation	2-3-3	
Credits	2 2/3	
Prerequisites		
Links: Backward	Backward: 101-211-VA Botany, 101-231-VA Microbiology, 202-311-VA Solution Chemistry	
<i>Forward</i>	145-561-VA Ecotoxicology	
<i>Current Semester</i>	None	
Course Description The course deals with the biological, chemical and technological aspects of waste remediation and management. The emphasis is on the microbiology of air, water, soil and sediment and the use of microbes in the destruction of hazardous wastes in these matrices.		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
<ul style="list-style-type: none"> Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects Analyzing samples taken in the field or in the lab 		<ul style="list-style-type: none"> In the classroom <ul style="list-style-type: none"> Lectures Class notes In the lab <ul style="list-style-type: none"> Physical and chemical techniques used in manipulating waste
Competency 044B: To describe the abiotic components of a natural environment.		
Element 1: Plan the work under their responsibility.		
<u>Performance Criteria</u> <ul style="list-style-type: none"> Determination of the sequence of all the steps involved in performing the work Determination of all required organizational and material means as well as the conditions for implementing them Location on maps of sampling points and stations Determination of the route to be taken in compliance with environmental constraints Respect budget constraints Respect time constraints related to the types of protocols and established deadline Consideration of all important health and safety aspects 		<u>Learning Outcomes</u> Students will be able to: <ul style="list-style-type: none"> List all the steps to be followed. Estimate time for each task. List all the physical and chemical agents to be used and verified if safer and less expensive alternatives can be used. Follow the health and safety aspects of physical and chemical agents to be used and their health and safety aspects verified using the appropriate MSDS (Material Safety Data Sheet).
Element 2: Take samples		
<u>Performance Criteria</u> <ul style="list-style-type: none"> Adequate use of techniques for sampling water, soils and sediments Respect defined protocols Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints 		<u>Learning Outcomes</u> Students will be able to: <ul style="list-style-type: none"> Perform air, water and soil sampling Use adequate physical and chemical techniques in the preservation, analysis and ultimate safe disposal of the samples.

<ul style="list-style-type: none"> • Optimal accuracy and quality of samples • Appropriate conservation of samples 	
Element 3: Analyze the samples	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Analysis of all the physical and physicochemical parameters required • Rigorous use of analysis instruments in compliance with prescribed techniques • Good tactile and visual sensitivity 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify and analyze the required parameters for a given sample. • Choose and utilize appropriate analytical instrument for a given task. • Develop good laboratory practices.
Element 4: Take the necessary measurements.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Measurement of all physical and physicochemical parameters required • Rigorous use of measuring instruments in compliance with prescribed techniques • Optimal accuracy and quality of measurements according to established protocols 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Carry out appropriate techniques relevant to the measurement of various physical and physicochemical parameters. • Properly use equipment necessary for such measurements. • Follow established protocols in order to maintain the precision and accuracy required in such measurements.
Element 5: Compile all the data	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete, correct inputting of data on worksheets • Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Correctly present the experimental data on worksheets using appropriate tabular and/or graphical representations. • Test data completeness and validity.
Element 6: Keep a technical log	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of the materials and products used • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> – Methodology – work context and conditions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • List equipment and chemicals used. • Describe methodology, present data, perform calculations and present the final result.
Competency 044C: To carry out laboratory analyses.	
Element 1: Plan the work under their responsibility	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • List all the steps to be followed. • Estimate time for each task. • List all the physical and chemical agents to be used and verified if safer and less expensive alternatives can be used. • Follow the health and safety aspects of physical and chemical agents to be used and their health and safety aspects verified using the appropriate MSDS (Material Safety Data Sheet).
Element 2: Perform the preliminary work required for the analyses	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper assembly, adaptation and calibration of equipment • Accurate calculations for the dilution and concentration of solutions • Accurate conversions of concentration units • Methodical preparation of solutions, using volumetric instruments and the required materials • Preparation and preprocessing of samples according to the types of analysis required 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Assemble and calibrate of the equipment needed to perform an analysis. • Calculate solution concentrations and prepare dilute solutions using stock solutions. • Relate various concentration units such as molarity, ppm, % etc. • Extract of ingredients from samples using appropriate preparation and processing of samples.
<p>Element 3: Perform biochemical, physiochemical and genetic analyses</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the analysis method(s) according to the defined protocol • Relevant proposals for minor adaptations according to the defined protocol • Rigorous application of analysis methods and adequate use of corresponding work techniques • Proper use of apparatus • Results in conformity with the defined study parameters • Rigorous application of health and safety measures, and respect of standards in effect • Accurate interpretation of material safety data sheets for the products used 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Follow principles of green chemistry. • Follow and safety aspects as discussed in the MSDS. • Use appropriate equipment and instrumentation.
<p>Element 4: Compile all the data</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete, correct inputting of data on worksheets • Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Compile and present data. • Test its completeness and validity.
<p>Element 5: Perform additional tasks related to the analyses</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Routine maintenance of laboratory equipment in compliance with the manufacturer's recommendations • Management of hazardous materials and biological waste in conformity with the laws and regulations in effect 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Calibrate all the instruments used. • Maintain and clean laboratory ware. • Keep workplace tidy. • Deal with the generated hazardous waste and unused chemicals either by converting them to less hazardous materials or appropriately packaging them for ultimate disposal as hazardous waste.
<p>Element 6: Keep a technical log</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Sequential description of all the operations performed • Complete list of the materials and products used as well as the organisms studied 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe methodology. • Log materials used.

Course Title	Plant Taxonomy
Course Code	145-511-VA
Competencies	044G: To analyze how fungi and plants live and adapt to their environment. 004P: To apply wilderness survival techniques. 044Q: To describe the biotic resources of an aquatic environment. 044R: To describe the biotic resources of a terrestrial environment.
Ponderation	2-3-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-211-VA Botany
Forward	145-621-VA Plant Inventory
Current Semester	None
Course Description The student will become familiar with major morphological characteristics used in the classification of the principal plant groups ranging from algae and lichens to conifers and flowering plants. The rules of nomenclature, classification, and cataloguing are included. In the field, the techniques of collecting and identification of samples are shown in various terrestrial and aquatic habitats. The use of keys is particularly emphasized in both laboratory and field settings, especially for dominant plant species which define the plant association, or are important food and cover resources for selected wildlife species.	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • While conducting analyses related to organisms. • Based on live or dead samples; specimens that have been given to or collected by the technician or that derive from a natural environment; information on the environment and the living conditions of fungi and plants; as well as established or standardized research protocols. • Using the required apparatus, lab tests, documentation, procedures and databases. • For all types of research focusing primarily on ecosystem characterization, including conservation and restoration • While performing tasks related to culture and breeding, bioassays, in vitro culture and the conservation of scientific collections • Working alone or in a team, with supervision and complying with all ethical considerations • Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input • Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects • For all types of research involving ecosystem characterization • Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a deadline and a predetermined budget as well as predetermined formats for data input 	<ul style="list-style-type: none"> • In the class <ul style="list-style-type: none"> - Lectures - Handouts - Text books - Fresh plant specimens - Discussion • In the lab <ul style="list-style-type: none"> - Preparation of survival packs - Use of taxonomic keys - Fresh reference material from aquatic and terrestrial habitats • In the field <ul style="list-style-type: none"> - Basic orienteering - Field trips – observation - Field trips - sampling

<ul style="list-style-type: none"> • While conducting analyses of samples taken from the field or in the lab • Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects • Introduction to map reading and the use of orienteering compasses • Preparation of survival packs for the field 	
<p>Competency 044G: To analyze how fungi and plants live and adapt to their environment.</p>	
<p>Element 2: Characterize the fungi and plants in order to identify them.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of the techniques and methods associated with culturing, transplanting and identifying fungi and plants • Use of apparatus associated with identifying fungi and plants according to established or standardized protocols • Proper application of health, safety and asepsis measures • Accurate description of the anatomical and morphological characteristics of fungi and plants • Identification of the fungi and plants present at the taxonomic level required by the research parameters 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Identify fungi and plants from different aquatic and terrestrial habitats • Recognize specific plant groups by their common anatomical and morphological characteristics • Use different apparatus to collect specific plant groups • Apply the norms for health and safety in field sampling, sample storage and lab analysis • Use callipers, microscopes, magnifiers, dissecting kits and taxonomic keys • Apply basic orienteering • Prepare and use survival packs in the field
<p>Element 3: Explain the connections between fungi and plants and their respective habitats.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant explanation of the main physiological mechanisms of fungi and plants according to their specificities • Relevant explanation of the role of fungi and plants in their respective habitats • Forecast assessment of the impact of environmental changes on the ability of fungi and plants to adapt and survive 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Become familiar with different morphology and structures in plants and fungi • Identify the role of various plant structures in successful growth, reproduction and survival • Recognize different plant association in disturbed and natural habitats • Recognize dominant plant communities • Distinguish between vascular and non-vascular plant groups
<p>Competency 044P: To apply wilderness survival techniques.</p>	
<p>Element 1: Apply the necessary preventive measures in a natural environment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Recognition of the sources of potential danger according to the types of tasks and the conditions for performing them • Establishment of an emergency plan • Preparation of all necessary materials • Communication of adopted measures to the persons concerned 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Prepare and carry a field survival pack • Post their location on a central map prior to field work • Estimate the time of return from field work • Plan an emergency escape route if lost
<p>Element 2: Find their bearings in an emergency situation.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of landmarks in order to determine their position • Determination of cardinal points based on clues in the environment • Determination of the direction required for their return 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Use GPS in the field • Enter GPS data onto GIS software for site locations • Interpret topographical maps • Perform basic orienteering with compasses

Element 3: Find food in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of edible species • Application of techniques for capturing animal species • Lighting of fire • Location of a source of drinking water 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify plants in the field • Access information on local edible plant species and plant parts by seasonal availability • Carry emergency food supplies, matches, snare wires, fish line and hooks and a basic medical kit and a survival pack • Apply tincture of iodine to purify water
Element 4: Find shelter in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate construction of a temporary shelter • Adequate protection against wind, cold and rain 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Access information on constructing emergency shelters • Use ground sheets and space blankets • Use knives, snare wire and fish line to construct shelters
Element 5: Adopt appropriate attitudes and behaviours in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Demonstration of self-control and level headedness • Ability to work independently and to be resourceful • Effective management of factors that could compromise their survival: <ul style="list-style-type: none"> • pain • cold • thirst • hunger • fatigue • boredom and isolation • hazards of all kinds 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Plan for an emergency situation • Have sufficient emergency supplies to overnight in the field • Access medical gear to treat or transport injured personnel • Use CPR and field first aid
Element 6: Manage the factors that could contribute to the survival of a group.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper, methodical organization of group members • Optimal use of each member's skills • Realistic study of the situation and demonstration of decision making appropriate to the circumstances • Quick reflexes and ability to apply survival skills 	<p><u>Learning Outcomes</u></p> <p>Students will be:</p> <ul style="list-style-type: none"> • Certified in field first aid and CPR prior to field work • Able to apply emergency procedures and distress signals
Competency 044Q: To describe the biotic components of a fresh- or saltwater environment.	
Element 2: Take inventories.	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of inventory methods • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Accuracy and quality of information gathered, in particular with respect to: <ul style="list-style-type: none"> – identifying the species present – counting the species present – delineating the distribution areas of the species present 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use different collecting apparatus in fast and slow water habitats • Sample plants from different water depths • Keep species lists of different plant groups from varied aquatic habitats • Distinguish different preservation techniques for plant samples
<p>Competency 044R: Characterize the biotic components of a terrestrial environment.</p>	
<p>Element 2: Perform Inventories.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Sufficient knowledge of inventory methods • Respect of established protocols • Demonstration of a degree of autonomy with respect to adapting methods and techniques required for a certain habitat • Precision and quality in sampling techniques • Identification, number and distribution of species present 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Work in small teams to sample disturbed and undisturbed terrestrial habitats • Take appropriate sampling gear for different habitat types • Follow health and safety procedures in the field • Do basic orienteering • Recognize large mature plants by growth form, height, bark, leaf and twig characteristics
<p>Element 3: Take samples</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Sufficient knowledge of sampling techniques of organisms or parts of organisms • Respect of established protocols • Demonstration of a degree of autonomy with respect to adapting methods and techniques required for a certain habitat • Precision and quality in sampling techniques • Adequate preservation of samples 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Take sufficiently large samples for identification to genus or species • Record details of the habitat type to assist in identification • Record species present in pioneer, transition and climax plant communities

Course Title	Entomology
Course Code	145-521-VA
Competencies	044H: To analyze how animals live and adapt to their environment 044J: To culture and maintain organisms.
Ponderation	2-2-1
Credits	1 2/3
Prerequisites	
Links: <i>Backward</i>	101-411-VA Invertebrate Zoology
<i>Forward</i>	None
<i>Current Semester</i>	145-531-VA Limnology, 145-541-VA Fisheries Management

Course Description

This course reviews basic anatomy, life cycles, physiology, and adaptations of insects to the aquatic and terrestrial environments. The economic impact of insects (both beneficial and deleterious) is discussed. The use of insects as environmental indicators, as part of an environmental impact assessment, and as biological controls is covered. Labs include demonstration and use of collecting gear and identification of both adult and larval insects collected around the field station.

ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> ▪ While performing research work needing characterization of biotic and abiotic resources of natural and controlled environments. ▪ Analysis work pertaining to organisms. ▪ From live or dead specimens as well as samples, gathered by the technician or from another source such as the natural habitat. ▪ Through necessary laboratory tests, apparatus, documentation, procedures and existing databases. ▪ In all types of research applications mainly geared towards the characterization of ecosystems without excluding their conservation and restoration. ▪ Work pertaining to the culture, raising, bioassays, <i>in vitro</i> culture and the conservation of scientific collections. ▪ Under supervision, individually or as part of a team and observing all ethical considerations. ▪ From standard methods and protocols; from water, soil or organism samples taken by the technician or supplied to the technician; from information pertaining to living conditions; from a pre-established budget and lastly from established formats for the collection of data. ▪ With all the necessary documentation pertaining to the apparatus, instruments and tools used as well as the logistics involved. ▪ In all types of research activities involving the characterization of an ecosystem. ▪ Solo or as part of a team, from standard research protocols, pre-established budgets and formats for the collection of data. ▪ Analyze samples in the field or in the lab. ▪ With all necessary documentation, essential apparatus, tools, instruments and all means pertaining to logistical aspects. 	<ul style="list-style-type: none"> • In class <ul style="list-style-type: none"> - lectures - handouts - textbook - reference texts - primary literature - discussions - case studies • In the lab-taxonomic keys <ul style="list-style-type: none"> - freshly caught insects - preserved insects from collections - pinning and alcohol preservation of specimens - correlate activity of insects with time and weather condition - determine relationships between physical and biological parameters of a habitat and taxa of insects present • In the field <ul style="list-style-type: none"> - correct use of sampling gear - collection of terrestrial, aquatic, and flying insects - record supplementary data related to collection of insects (e.g., dates, times, weather conditions at time of collection)

Competency 044H: To analyze how animals live and adapt to their environment.	
Element 1: To characterize the animals for identification	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of techniques and methods associated with the identification of specimens. • Adequate use of apparatus associated with the identification of animals. • Correct description of anatomical and morphological characteristics of animals. • Identification of animals present at the required taxonomic level in accordance with the parameters of the research project. 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use taxonomic keys and field guides to identify aquatic, terrestrial, and flying insects to family • Handle, maintain, and use dissecting microscopes and light sources • Describe and identify all taxonomically relevant structures used in taxonomic keys and field guides • Individually and/or in groups, identify to family and count all insects collected during field surveys.
Element 2: To explain the bonds that exist between the characteristics of the animals and their habitat.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Pertinent explanation of the main physiological principles specific to animals. • Pertinent explanation covering the role of animals in their habitat. • Forecasting the impact of environmental changes on the capacity for adaptation and survival of animals. 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain the principle aspects of insect physiology • Explain the interactions of insect physiology with physical and chemical parameters in the environment (e.g., temperature moisture light, chemicals such as pesticides. Be able to describe the economic impact of insects, both beneficial and deleterious • Explain the role of insects in environmental impact assessment and as indicators of climate change
Competency 044J: To culture and maintain organisms.	
Element 3: To perform duties pertaining to the preservation of scientific collections	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Sampling and adequate harvesting of required specimens. • Specimen preparation according to the requirements of the collection. • Specimen identification to the required taxonomic level. • Adequate use of apparatus. • Adequate use of classification systems for the taxon under study. • Rigorous application of preservation methods. 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use various sampling gear used to collect both aquatic and terrestrial, and flying insects • Efficiently and humanly kill, prepare, and label aquatic terrestrial, and flying insects for inclusion into a collection • Use taxonomic keys and field guides to identify insects to family • Use killing jars, pinning boards, and storage vials to prepare insects for inclusion into a collection. • Place the insect taxon under study in the currently accepted taxonomy of the Class Insecta. • Apply correct preservation methods (both dry and wet) to insect specimens

Course Title	Limnology
Course Code	145-531-VA
Competencies	<p>0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p> <p>044A : To use digital and computer technologies on the job.</p> <p>044B: To describe the abiotic components of a natural environment.</p> <p>044K: To plan the technical and logistical aspects of an applied research project.</p> <p>044L: To work in a team.</p> <p>044M: To use a variety of field equipment.</p> <p>044Q: To describe the biotic components of a fresh- or saltwater environment.</p> <p>044T: To conduct an ecosystemic analysis of a territory.</p>
Ponderation	2-3-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-311-VA Ecology, 202-311-VA Solution Chemistry
Forward	145-651-VA Ecological Cartography, 145-661-VA Environmental G.I.S.
Current Semester	145-521-VA Entomology, 145-541-VA Fisheries Management, 145-561-VA Ecotoxicology
<p>Course Description This course reviews the biological, chemical, and physical characteristics and functions of streams and lakes from a watershed perspective. Various usage and management issues are also considered. Labs introduce the student to both laboratory and field skills, equipment, and methodologies.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • While conducting watershed analyses in an ecological time scale • While conducting analyses including field work (when certain data provided must be validated) and the interpretation of thematic maps and aerial photographs • Based on all the soil, sediment and water samples provided, meteorological data and a minimal description of the organisms found • Using appropriate tools: instruments required for analyzing aerial photographs and maps • For all work-related tasks • Using applications related to geomatics, cartography and the presentation of data and scientific information • For all types of research involving ecosystem characterization • Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a predetermined budget as well as predetermined formats for data input • Analyzing samples taken in the field or in the lab • Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects • For all types of research applied to a natural environment, performed in the field or in a lab • Working alone or in a team, with supervision and based on a predefined research protocol, a general description of the tasks to be performed, a predetermined budget and a timetable 	<ul style="list-style-type: none"> • In the classroom <ul style="list-style-type: none"> - Lectures - Discussion - Textbook - Class notes • In the field <ul style="list-style-type: none"> - Field sampling, collections, & observations related to streams, lakes, watersheds • In the lab <ul style="list-style-type: none"> - Testing and interpretation of field-collected water and biotic samples & data, using analytical equipment such as water quality meters, spectrophotometers, titration equipment • Geomatics <ul style="list-style-type: none"> - Special assessment of field & lab information using specialized computer software

<ul style="list-style-type: none"> • For work carried out as part of a disciplinary or multidisciplinary team • Using various transportation vehicles, watercraft, positioning and communications equipment, and equipment and accessories required for field work (characterization, experimental research, land-use planning, etc.) • Using the required materials: manufacturers' manuals in English and French, tools and products required for the routine maintenance of vehicles, watercraft and equipment; capturing, measuring, listening and general inventory materials • Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a deadline and a predetermined budget as well as predetermined formats for data input • While conducting analyses of samples taken from the field or in the lab • Based on guidelines pertaining to a clearly defined problem: population dynamics, condition of a habitat; the planning, use and conservation of resources; impact studies, etc. • Preparing a summary using all the studies on the environment in question and all the required data, in particular georeferenced and thematic maps, databases, research and inventory reports • Using the required computer tools and corresponding applications 	
<p>Competency 0449: To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p>	
<p>Element 1: Describe the relief of a watershed.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate interpretation of different thematic maps and aerial photographs • Delineation of the watershed and description of its geomorphologic aspects 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Use GIS & imagery products to assess field sites, areas, and features.
<p>Element 3: Analyze the factors that influence the main physicochemical properties of fresh water environments.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Description of the main physicochemical properties of fresh water environments • Explanation of the influence of climate, runoff and currents on the properties of fresh water environments 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Apply theoretical ideas to real situations • Employ relevant sampling and analytical technology to assess such properties
<p>Competency 044A : To use digital and computer technologies on the job.</p>	
<p>Element 2: Use word-processing applications.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formatting of scientific documents • Creation of templates and style sheets • Importing and integration of various elements 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Adapt the standards of scientific writing, while using computers, to relevant applications.
<p>Competency 044B : To describe the abiotic components of a natural environment.</p>	
<p>Element 1: Plan the work under his supervision.</p>	
<p><u>Performance Criteria</u></p>	<p><u>Learning Outcomes</u></p>

<ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points and stations • Determination of the route to be taken in compliance with environmental constraints • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Plan work in the field, including organizing gear requirements, scheduling time. • On site, arrange stations and conduct required work in a scientifically rigorous way, divide work among team members. • Work in a safe manner, have standard 1st aid supplies available, know how to respond in an emergency.
<p>Element 2: Take samples</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of techniques for sampling water, soils and sediments • Respect defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Optimal accuracy and quality of samples • Appropriate conservation of samples 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Properly employ scientific procedures following accepted standards. • Treat samples so that they can be transported to lab for analyses.
<p>Element 3: Analyze samples.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Analysis of all the physical and physicochemical parameters required • Rigorous use of analysis instruments in compliance with prescribed techniques • Good tactile and visual sensitivity 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Practice learned procedures in a skilful way so as to result in quality data.
<p>Competency 044K: To plan the technical and logistical aspects of an applied research project.</p>	
<p>Element 1: Analyze the determining parameters of the project.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous analysis of the problem and questions on which the research is based • Clear explanation of the project's objectives and issues • List of all of the project's important determinants, including those related to ethics 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Comprehend and contribute to the questions that will be investigated in a stream & watershed survey. • Conduct the survey in a manner consistent with the stated objectives.
<p>Element 2: Describe the tasks and operations associated with the project.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of relevant tasks and operations • Presentation of the different tasks in a logical sequence • Applicability of the sequence proposed • Optimal management of time allotted 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Prior to going to the field, establish a work plan that meets the objectives in the time available.
<p>Element 5: Take the legislative framework into account and adjust their planning accordingly.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of all procedures related to laws and regulations in effect • Acquisition of required permits and authorizations • Planning in conformity with laws and regulations in effect 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Conduct their field activities in agreement with the regulations and guidelines that they have learned.

Competency 044L : To work in a team.	
Element 1: Exercise positive leadership within a team.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Competent exercise of the role of team leader when the circumstances require it • Balanced, equitable sharing of tasks and responsibilities among team members • Effective management of potentially conflictual situations • Proper leadership provided for tasks to be performed • Openness to constructive criticism • Significant contribution to creating an atmosphere of collaboration and consensus • Formulation of relevant recommendations aimed at improving the effectiveness of the team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Assume the role of both group leader and team member, in the field and in the lab. Given the typical operation of the field station environment, this is a standard aspect of the learning experience. They will be graded on their ability to responsibly fill such roles.
Element 2: Participate actively in the team effort, taking on their share of responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper preparation of work meetings and their personal participation • Active contribution to achieving the objectives set by the team • Organized presentation of their views on different topics on the agenda • Clear, logical arguments proposed in support of their opinions • Adequate emotional control with respect to interpersonal conflict and diverging opinions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Benefit and profitably use feedback and review from faculty/staff on their demonstrated team involvement. • Improve their team skills via contributing to team-based field and lab exercises.
Element 3: Adapt to the people they are working with.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Continued effort to understand the occupational realities of the people they work with and the terminology they use <ul style="list-style-type: none"> – Accurate understanding of the dynamics among the various persons concerned: – determinants related to the specific cultural practices and aspects of the persons concerned – ongoing and completed project activities on the agenda – issues and interests defended by each party – quality and history of relationships between the various persons concerned • Adaptation of their language, approach and attitudes to the characteristics of the persons they are working with • Demonstration of a real ability to create a climate conducive to harmonious, productive work within a heterogeneous team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Adapt to working on a number of different teams of colleagues, as team composition changes from exercise to exercise during the course. • Receive feedback from faculty/staff based on their performance in this various working situations.
Element 4: Establish and maintain proper professional relationships within a team.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Establishment of professional credibility and objectivity with their colleagues and other 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Build upon the quality of their performance and

<p>persons concerned</p> <ul style="list-style-type: none"> • Adoption of attitudes conducive to maintaining good professional relationships: <ul style="list-style-type: none"> – respect – attentive listening – ethics – rigour • Projection of a polished professional image adapted to the circumstances 	<p>professionalism as they gain experience participating within team activities.</p>
<p>Competency 044M : To use a variety of field equipment</p>	
<p>Element 1: Obtain information on how to operate and maintain various pieces of equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Careful reading of user manuals • Brief explanation of how various pieces of equipment are made and how they work • Development of procedures summarizing how to use the equipment • Preparation of maintenance sheets for the other team members 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Review manuals and other documentation relating to scientific equipment so as to properly use, calibrate, troubleshoot, maintain the technology.
<p>Element 2 : Operate various pieces of equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Thorough verification of equipment prior to use • Application of procedures for adjusting and fine-tuning equipment prior to use • Safe, proper use of equipment • Respect standards and regulations in effect 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Check, prepare, operate, and safely utilize assorted lab and field equipment.
<p>Element 3: Perform routine and preventive maintenance on the equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Respect for the inspection schedule recommended by the manufacturer • Adequate use of basic techniques: <ul style="list-style-type: none"> – removal and installation of certain components – lubrication – routine adjustments – replacement of various parts • Safe use of tools and products required for maintenance • Proper maintenance of equipment for storage purposes 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Properly maintain equipment on the basis of learning they will have achieved through viewing demonstration by staff, reviewing manuals, and practicing by themselves.
<p>Element 4: Apply troubleshooting methods in the event of equipment breakdown.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate identification of the nature and scope of the problem • Effective solution of the problem • Ability to work independently, and to be resourceful and innovative 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Respond to equipment problems and failures on the basis of knowing both the theory behind their operation and having gained experience with using them.
<p>Competency 044Q : To describe the biotic components of a fresh- or saltwater environment</p>	
<p>Element 1 : Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the tasks • Determination of all required organizational and material means as well as the conditions for implementing them 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Take an active role in planning field activities, including choosing sampling sites. • Safely utilize sampling techniques that will allow description of biotic components.

<ul style="list-style-type: none"> • Location on maps of sampling points and stations • Determination of the route to be taken in compliance with environmental constraints • Respect for budget constraints • Respect for time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<ul style="list-style-type: none"> • Work within the timeframes available to complete the assigned tasks.
Element 3 : Take samples.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of techniques for sampling organisms or parts of organisms • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Optimal accuracy and quality of samples • Appropriate conservation of samples 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe the characteristics and limits of sampling methodology • Adapt techniques in appropriate fashion, in the collection of biological, chemical, and physical samples.
Element 4: Analyze the samples.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Appropriate preparation of samples and materials according to the type of analysis to be done • Analysis of all required parameters according to established protocols • Rigorous use of analysis instruments in compliance with prescribed techniques • Accuracy of results according to research requirements 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Follow up sample collecting in the field with appropriate lab assessment, using the resources available, with the overall aim of generating high quality results.
Element 5 : Take the required measurements.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Measurement of all required parameters • Rigorous use of measuring instruments in compliance with prescribed methods and techniques • Optimal accuracy and quality of measurements according to established protocols 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify and explain the required levels of accuracy with respect to usage of instruments of measurement.
Element 6: Compile all the data.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete, correct inputting of data on worksheets • Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Design and utilize suitable worksheets for both lab and field usage and, as standard practice, come to be of the habit of verifying content before submission or distribution.
Element 7: Keep a technical log.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of materials and products used • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> – Methodology – work context and conditions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Confirm manner and accuracy of work done by regularly recording activities done and technology employed.

Element 8: Analyze and interpret the data.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Establishment of a summary portrait of the ecosystem's biotic components Formulation of a plausible hypothesis on the condition of the communities, populations and organisms in terms of the ecosystem's characteristics 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Summarize findings and synthesize the knowledge gained and apply it relative to the objectives of the work or the questions asked at the outset.
Competency 044T: To conduct an ecosystemic analysis of a territory	
Element 1: Participate in planning the work according to the initial problem.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Determination of the different aspects and components to be analyzed Strategic distribution of work among team members Development of a common methodology and analysis grid 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Assess the work to be done, appreciate its component parts, and devise an approach relative to available resources and personnel.
Element 2: Acknowledge the data components relative to the natural environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Rigorous analysis of data on the biotic or abiotic resources specific to the components studied Extraction of data relevant to the initial problem Justification of data retained and summary processing of the data Summary reconciling the common points and differences among various studies Formulation of an overall impression of the component(s) analyzed 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Recognize the value and validity of data collected from lab or field Reach conclusions as to its applicability and the role it may or may not have relative to the work at hand.
Element 3: Establish the interactions among the different components.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Clear, accurate and brief reporting Highlighting of the predominant interactions among components in terms of the initial problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Differentiate between the contributions made by the various elements under study and thereafter verbally convey this information.
Element 4: Participate in producing a summary portrait of the environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Formulation of a diagnostic impression to determine the predominant factors accounting for the dynamics of the environment Determination of factors that may be influenced 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Extract the primary points of importance in terms of what was learned and how these describe the environment.
Element 5: Participate in formulating recommendations for solving the initial problem.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Relevance and feasibility of the recommendations formulated 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Proceed from the information gained from the investigation and offer informed opinions of the practical significance of the findings.

Course Title	Fisheries Management
Course Code	145-541-VA
Competencies	044E: To convey scientific information. 044H: To analyze how animals live in and adapt to their environment. 044J: To culture and maintain organisms. 044K: To plan the technical and logistical aspects of an applied research project. 044L: To work in a team. 044M: To use a variety of field equipment. 044P: To apply wilderness survival techniques. 044Q: To describe the biotic of a fresh- or saltwater environment. 044S: To act within the legal and ethical parameters of the field. 044T: To conduct an ecosystemic analysis of a territory.
Ponderation	1-4-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-311-VA Ecology, 101-321-VA Vertebrate Form and Function 2, 101-411-VA Invertebrate Zoology, 145-311-VA Vertebrate Taxonomy
Forward	145-651-VA Ecological Cartography, 145-661-VA Environmental G.I.S.
Current Semester	145-521-VA Entomology, 145-531-VA Limnology
Course Description	
<p>This course reviews the management, ecology, and biology of fish and [principally recreational] fisheries in inland Canadian waters. Among the areas included are population dynamics, the conservation and rehabilitation of habitat, and laws and regulations. Labs include boating safety, collection gear usage and fish sampling, fish husbandry.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • For purposes of interpretation and training, scientific popularization and the production of scientific materials, including technical reports and parts of research reports • Based on specific requests and expressed or perceived information needs • Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer equipment and any other appropriate apparatus • Working on research that involves characterizing biotic and abiotic resources in natural and controlled environments. • While conducting analyses related to organisms. • Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols • Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases • For all types of research focusing primarily on ecosystem characterization, including conservation and restoration • While performing tasks related to culture and breeding, bioassays, <i>in vitro</i> culture and the conservation of scientific collections. • Working alone or in a team, with supervision and complying with all ethical considerations 	<ul style="list-style-type: none"> • In the classroom <ul style="list-style-type: none"> - Lectures - Discussion - Textbook - Class notes • In the field <ul style="list-style-type: none"> - Field sampling, collections, & observations related to effectively examining fishes in inland waters. - Practice in maintaining an on-site aquaculture operation. - Mark and recapture techniques. - Small boat handling and safety on the water. • In the lab <ul style="list-style-type: none"> - Refamiliarization to taxonomy (follow-up to Vertebrate Taxonomy 145-311). - Age assessment techniques and relevance to management.

- Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input.
- Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects
- In an emergency situation and in extreme conditions.
- Working alone or in a team.
- Using basic survival materials and a basic first-aid kit.
- For all types of research involving ecosystem characterization.
- Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a predetermined budget as well as predetermined formats for data input.
- Analyzing samples taken in the field or in the lab
- For all work-related activities
- In accordance with the laws and regulations in effect, in particular the *Forest Act*, *Environment Quality Act*, *An Act respecting the conservation and development of wildlife* and the guidelines developed by the Canadian Council on Animal Care.
- In accordance with the legal guidelines applicable to the issue of permits and authorizations.
- As part of a team, with supervision and under the aegis of public, parapublic or private authorities, and working in terrestrial fresh- and saltwater environments.
- While performing tasks for purposes of characterizing an environment, establishing master plans and action plans, evaluating the impact of various activities on the environment as well as possibly carrying out interpretation and education activities, etc.
- Based on guidelines pertaining to a clearly defined problem: population, condition of a habitat; the planning, use and conservation of resources; impact studies, etc.
- Preparing a summary using all the studies on the environment in question and all the required data, in particular georeferenced and thematic maps, databases, research and inventory reports.
- Using the required computer tools and corresponding applications

Competency 044E: To convey scientific information.	
Element 2: Determine the objectives, approach and content of the communications.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate, relevant objectives defined • Methodical, effective review of literature on the subject • Selection of content based on relevance to objectives pursued • Determination of a communication approach and strategies adapted to these specific aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Effectively use computer slide presentation tools to address an audience on topics of scientific or management significance.
Element 3: Plan and organize the content of the communications.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Validation of the accuracy of the content with the qualified authorities • Strategic selection of communication means and media • Content and format of materials organized in order to communicate appropriate educational and strategic information 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Critically review relevant information sources as the basis of creating their presentation. • Employ the presentation software in a manner suitable for the target audience.
Element 4: Produce all the elements required for the communications.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Quality of the different communication elements produced: texts, images, tables, presentations • Appropriate popularization of the content of the communications • Use of terminology and language adapted to the target audience • General quality of the language and organization of the different communication elements • Consideration of applicable presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Select the features of the communication technology that are appropriate for the nature of the information to be communicated. • Adjust the level of delivery so as to be appropriate for the given audience.
Element 5: Present the content of the communications.	
Element 6: Evaluate the effectiveness of the communication in order to make improvements.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Strategic evaluation of the achievement of initial objectives • Identification of elements that could be improved • Accurate modification of the different elements based on the weaknesses observed 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Following delivery of the presentations by the group, partake in a debriefing session, so as to learn from observed problems and strong points.
Competency 044H: To analyze how animals live in and adapt to their environment.	
Element 1: Characterize the animals in order to identify them.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> ▪ Rigorous application of techniques and methods associated with the identifying specimens. ▪ Proper use of apparatus associated with identifying animals. ▪ Accurate description of anatomical and morphological characteristics of animals. ▪ Identification of animals at the taxonomic level required by the research parameters. 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe, identify, and use relevant biological structures to, in concert with keys and field guides, accurately identify both collected and inventoried specimens.

Element 2: Explain the connections between the characteristics of the animals and their respective habitats.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> ▪ Relevant explanation of the main physiological mechanisms of animals according to their specificities. ▪ Relevant explanation of the role of animals in their respective habitats. ▪ Forecast assessment of the impact of environmental changes on the animals' ability to adapt and survive. 	<p><u>Learning Outcome</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Synthesize learned theory relating to biology with observations gained in the field so as to gain a complete understanding of the animal roles, functions, and vulnerabilities.
Competency 044J: To culture and maintain organisms.	
Element 3: Perform tasks related to the conservation of scientific collections.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> ▪ Proper sampling and collection of the specimens required ▪ Preparation of specimens according to the specific requirements of a scientific collection ▪ Identification of the specimens at the required taxonomic level ▪ Proper use of apparatus ▪ Proper use of classification systems specific to the taxon studied ▪ Rigorous application of conservation methods 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Collect, taxonomically identify, prepare, and catalogue fish specimens for an in-house maintained collection.
Competency 044K: To plan the technical and logistical aspects of an applied research project.	
Element 3: Determine the resources required.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the types and quantities of resources required • Appropriate use of different catalogues • Establishment of an exhaustive list of resources pertaining to lodging, transportation, food, equipment and safety • Establishment of an exhaustive list of materials involved in applying the protocol (technical aspects) 	<p><u>Learning Outcome</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Partake in planning fishing in the field, using several types of selected scientific sampling methodologies • Identify and organize the equipment needed • Identify the safety risks while conducting the field work and follow required protocols.
Competency 044L: To work in a team.	
Element 1: Exercise positive leadership within a team.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Competent exercise of the role of team leader when the circumstances require it • Balanced, equitable sharing of tasks and responsibilities among team members • Effective management of potentially conflictual situations • Proper leadership provided for tasks to be performed • Openness to constructive criticism • Significant contribution to creating an atmosphere of collaboration and consensus • Formulation of relevant recommendations aimed at improving the effectiveness of the team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Assume a leadership role, following leadership guidelines. • Liaise between students and faculty/staff on organization, status, and productivity of various projects/activities. • Direct and assist fellow students in achieving desired goals.
Element 2: Participate actively in the team effort, taking on their share of responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper preparation of work meetings and their 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p>

<p>personal participation</p> <ul style="list-style-type: none"> • Active contribution to achieving the objectives set by the team • Organized presentation of their views on different topics on the agenda • Clear, logical arguments proposed in support of their opinions • Adequate emotional control with respect to interpersonal conflict and diverging opinions 	<ul style="list-style-type: none"> • Work cooperatively with fellow students to achieve common goals. • Play a positive role in resolving difficulties that may arise.
<p>Element 3: Adapt to the people they are working with.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Continued effort to understand the occupational realities of the people they work with and the terminology they use • Accurate understanding of the dynamics among the various persons concerned: <ul style="list-style-type: none"> – determinants related to the specific cultural practices and aspects of the persons concerned – ongoing and completed project activities on the agenda – issues and interests defended by each party – quality and history of relationships between the various persons concerned • Adaptation of their language, approach and attitudes to the characteristics of the persons they are working with • Demonstration of a real ability to create a climate conducive to harmonious, productive work within a heterogeneous team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Realize that differences of opinion and approach may exist. • Recognize and explain the value of compromise and accommodation in the interest of attaining results.
<p>Element 4: Establish and maintain quality professional relationships within a team.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Establishment of professional credibility and objectivity with their colleagues and other persons concerned • Adoption of attitudes conducive to maintaining good professional relationships: <ul style="list-style-type: none"> – respect – attentive listening – ethics – rigour • Projection of a polished professional image adapted to the circumstances 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Contribute toward insuring that teamwork occurs in a professional manner. • Realize that the demonstration of fairness in all team endeavours is in the interest both of productivity and the image of the team.
<p>Competency 044M : To use a variety of field equipment.</p>	
<p>Element 1: Obtain information on how to operate and maintain various pieces of equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Careful reading of user manuals • Brief explanation of how various pieces of equipment are made and how they work • Development of procedures summarizing how to use the equipment • Preparation of maintenance sheets for the other team members 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Review manuals and other documentation relating to scientific equipment so as to properly use, calibrate, troubleshoot, maintain the technology.
<p>Element 2 : Operate various pieces of equipment.</p>	
<p><u>Performance Criteria</u></p>	<p><u>Learning Outcomes</u></p>

<ul style="list-style-type: none"> • Thorough verification of equipment prior to use • Application of procedures for adjusting and fine-tuning equipment prior to use • Safe, proper use of equipment • Respect standards and regulations in effect 	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Check, prepare, operate, and safely utilize assorted lab and field equipment.
<p>Element 3: Perform routine and preventive maintenance on the equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Respect for the inspection schedule recommended by the manufacturer • Adequate use of basic techniques: <ul style="list-style-type: none"> – removal and installation of certain components – lubrication – routine adjustments – replacement of various parts • Safe use of tools and products required for maintenance • Proper maintenance of equipment for storage purposes 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Properly maintain equipment on the basis of learning they will have achieved through viewing demonstration by staff, reviewing manuals, and practicing by themselves.
<p>Element 4: Apply troubleshooting methods in the event of equipment breakdown.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate identification of the nature and scope of the problem • Effective solution of the problem • Ability to work independently, and to be resourceful and innovative 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Respond to equipment problems and failures on the basis of knowing both the theory behind their operation and having gained experience with using them.
<p>Competency 044P: To apply wilderness survival techniques</p>	
<p>Element 1: Apply the necessary preventive measures in a natural environment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Recognition of the sources of potential danger according to the types of tasks and the conditions for performing them • Establishment of an emergency plan • Preparation of all necessary materials • Communication of adopted measures to the persons concerned 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Conduct themselves safely in the field, via employing small boats in the safe manner in which they've been instructed (with all required safety equipment on board), and similarly when working by water on land. • Prepared to conduct themselves safely in an emergency situation on the basis of the Wilderness 1st Aid course they will have completed.
<p>Element 5: Adopt appropriate attitudes and behaviours in an emergency situation.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Demonstration of self-control and level headedness • Ability to work independently and to be resourceful • Effective management of factors that could compromise their survival: <ul style="list-style-type: none"> – pain – cold – thirst – hunger – fatigue – boredom and isolation – hazards of all kinds 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • On the basis of their training in the Wilderness 1st Aid course, identify and demonstrate safe and appropriate conduct in an emergency situation.
<p>Element 6: Manage the factors that could contribute to the survival of a group.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper, methodical organization of group members 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p>

<ul style="list-style-type: none"> • Optimal use of each member’s skills • Realistic study of the situation and demonstration of decision making appropriate to the circumstances • Quick reflexes and ability to apply survival skills 	<ul style="list-style-type: none"> • On the basis of their training in the Wilderness 1st Aid course, identify and demonstrate safe and appropriate conduct in an emergency situation.
<p>Competency 044Q: To describe the biotic of a fresh- or saltwater environment.</p>	
<p>Element 1 : Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the tasks • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points and stations • Determination of the route to be taken in compliance with environmental constraints • Respect for budget constraints • Respect for time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Take an active role in planning field activities, including choosing sampling sites. • Safely utilize sampling techniques that will allow description of fish habitats. • Work within the timeframes available to complete the assigned tasks.
<p>Element 3 : Take samples.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of techniques for sampling organisms or parts of organisms • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Optimal accuracy and quality of samples • Appropriate conservation of samples 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • identify the characteristics and limits of capture methodology and use same in field in appropriate fashion, in the collection of fisheries samples.
<p>Element 4: Analyze the samples.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Appropriate preparation of samples and materials according to the type of analysis to be done • Analysis of all required parameters according to established protocols • Rigorous use of analysis instruments in compliance with prescribed techniques • Accuracy of results according to research requirements 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Prepare samples collected in the field for lab analysis • Use appropriate available equipment • Generate high quality results. • Analyse population parameters for management (i.e. harvesting limits, habitat management, aquaculture, fish stocking levels, etc.)
<p>Element 5 : Take the required measurements.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Measurement of all required parameters • Rigorous use of measuring instruments in compliance with prescribed methods and techniques • Optimal accuracy and quality of measurements according to established protocols 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Adhere to, and identify, the required levels of accuracy with respect to usage of instruments of measurement.

Element 6: Compile all the data.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete, correct inputting of data on worksheets • Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Design and utilize suitable worksheets for both lab and field usage and, as standard practice, come to be of the habit of verifying content before submission or distribution.
Element 7: Keep a technical log.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of materials and products used • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> – Methodology – work context and conditions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Consistently record activities carried out • Consistently record techniques employed.
Element 8: Analyze and interpret the data.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Establishment of a summary portrait of the ecosystem's biotic components • Formulation of a plausible hypothesis on the condition of the communities, populations and organisms in terms of the ecosystem's characteristics 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Summarize findings and synthesize the knowledge gained and apply it relative to the objectives of the work or the questions asked at the outset.
Competency 044S: To act within the legal and ethical parameters of the field	
Element 1: Learn about the legal and ethical parameters that apply to various work-related situations.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of the different aspects of the protocol affected by these parameters • Determination of the authorities, laws and regulations concerned • Identification and consultation of relevant information sources 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply the relevant concepts that they have learned in theory (relative to fish collection and treatment) to the various field situations in which they may find themselves.
Element 2: Evaluate the practical consequences of the parameters on their work-related tasks.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of constraints, limits and obligations ensuing from the legal framework • Methodical review of the protocol and work plan with respect to the legal and ethical parameters • Adjustment of logistical and practical aspects under their responsibility • Accurate communication of relevant information to the persons concerned 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Conduct their field activities in such a way that they will satisfy the needs of the protocols and permits under which they are working.
Element 3: Participate in the application of the laws and regulations that pertain to their field.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Preparation of the forms required to obtain permits and authorizations • Adoption of professional practices in compliance with laws and regulations • Relevant dealings with users of an environment for education purposes 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Act within the conditions presented by authorizing agencies, with respect to gear type used, times of year when field collection is done, the range of species that may be taken.
Element 4: Conduct themselves in an ethical manner in their work-related activities.	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Ongoing demonstration of openness to the values and prerogatives of others • Attitude of intellectual honesty at all times • Application of ethical practices • Constant concern for the impact of their practices on organisms and their habitats • Constant concern for the impact of their practices on human communities 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply to the field and workplace a set of ethics that are accepted by the industry, such that specimens and habitats are treated correctly, the resultant data are characterized by scientific rigour, and a high degree of competence is publicly evident.
<p>Competency 044T: To conduct an ecosystemic analysis of a territory</p>	
<p>Element 1: Participate in planning the work according to the initial problem.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the different aspects and components to be analyzed • Strategic distribution of work among team members • Development of a common methodology and analysis grid 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify the different elements/tasks to be accomplished while using selected scientific fishing methods in the field • With his/her team, assign roles and cooperate in fulfilling a role in the fishing activity and assist the others in doing the same.

Course Title	Ornithology
Course Code	145-551-VA
Competencies	044H: To analyze how animals live in and adapt to their environment. 044R: To describe the biotic components of a terrestrial environment. 044S: To act within the legal and ethical parameters of the field.
Ponderation	1-4-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-311-VA Ecology, 145-311-VA Vertebrate Taxonomy
Forward	None
Current Semester	None
Course Description	
<p>The objectives are to learn, use, and master the main methods and equipment required in the census, inventory, conservation, and management of birds and their habitats. This course covers the techniques used for observation, inventory and sampling of populations, indices for age, sex, health, productivity and survival, causes of mortality, and the methods of habitat management. Legislation specific to various groups of birds (e.g. migratory species, endangered species, game species, and pests) are also included. The fieldwork stresses population monitoring through capture, species identification, aging, sexing, banding and record-keeping. Habitat analysis and management techniques are also demonstrated, particularly for economically important species.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • Working on research that involves characterizing biotic and abiotic resources in natural and controlled environments • While conducting analyses related to organisms • Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols • Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases • For all types of research focusing primarily on ecosystem characterization, including conservation and restoration • While performing tasks related to culture and breeding, bioassays, <i>in vitro</i> culture and the conservation of scientific collections • Working alone or in a team, with supervision and complying with all ethical considerations • Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input • Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects • For work carried out as part of a disciplinary or multidisciplinary team 	<ul style="list-style-type: none"> • In Class <ul style="list-style-type: none"> - lectures - handouts - textbooks - reference collections of biological material - discussion • In the Lab <ul style="list-style-type: none"> - taxonomic keys for identification - reference material of biological specimens - age and sex criteria for specific groups - data sheets for field banding • In the Field <ul style="list-style-type: none"> - use, placement and maintenance of mist nets and waterfowl traps - capture, identification, aging, sexing and banding - observations on and measurements of captured birds - record keeping of data from captured birds - remote sensing of birds

<ul style="list-style-type: none"> • In meetings and as part of heterogeneous teams made up of representatives of different users of a given territory • For all types of research involving ecosystem characterization • Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a predetermined budget as well as predetermined formats for data input • Analyzing samples taken in the field or in the lab • For all work-related activities • In accordance with the laws and regulations in effect, in particular the <i>Forest Act, Environment Quality Act, An Act respecting the conservation and development of wildlife</i> and the guidelines developed by the Canadian Council on Animal Care • In accordance with the legal guidelines applicable to the issue of permits and authorizations • Using the required documentation 	
<p>Competency 044H: To analyze how animals live in and adapt to their environment.</p>	
<p>Element 1: Characterize the animals in order to identify them.</p>	
<p><u>Performance Criteria</u> Rigorous application of techniques and methods associated with the identifying specimens.</p> <ul style="list-style-type: none"> ▪ Proper use of apparatus associated with identifying animals. ▪ Accurate description of anatomical and morphological characteristics of animals. ▪ Identification of animals at the taxonomic level required by the research parameters. 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Use field guides and government approved manuals to identify, age, sex and band birds • Maintain and use mist nets, hand magnifiers, spring balances, aluminum leg bands • Describe & identify all taxonomically relevant structures used in identification, aging & sexing using skeletal material, study skins, and live, captured birds • Individually identify birds to species, select and apply the appropriate band • Take appropriate measurements to establish age and sex • Use audial and optical remote sensing apparatus
<p>Competency 044R: To describe the biotic components of a terrestrial environment.</p>	
<p>Element 2: Take inventories.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of inventory methods • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Accuracy and quality of information gathered, in particular with respect to: <ul style="list-style-type: none"> – identifying the species present – counting the species present – delineating the distribution areas of the species present 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Set up mist nets relative to habitat vegetation characteristics and bird feeders • Remove birds from mist nets • Identify, age and sex captured birds • Enter data on banding schedules
<p>Element 3: Take samples.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of techniques for sampling 	<p><u>Learning Outcomes</u> Students will be able to:</p>

<ul style="list-style-type: none"> organisms or parts of organisms Respect for defined protocols Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints Optimal accuracy and quality of samples Appropriate conservation of samples 	<ul style="list-style-type: none"> Check capture nets on a regular schedule Determine appropriate criteria for species identification, age and sex
Element 5: Take the required measurements.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Measurement of all required parameters Rigorous use of measuring instruments in compliance with prescribed methods and techniques Optimal accuracy and quality of measurements according to established protocols 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Use field instruments for body measurements Make observations on the age and breeding status
Element 6: Compile all the data.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Complete, correct inputting of data on worksheets Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Record data on standardized banding schedules Record criteria used to establish age and sex
Competency 044S: To act within the legal and ethical parameters of the field.	
Element 1: Learn about the legal and ethical parameters that apply to various work-related situations.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Complete list of the different aspects of the protocol affected by these parameters Determination of the authorities, laws and regulations concerned Identification and consultation of relevant information sources 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Identify and describe the limits imposed using scientific permits for bird capture and banding under the Federal Migratory Birds Convention Identify and describe the hunting regulations and conditions with respect to the Migratory Birds Convention Identify and describe the sources for Federal/Provincial regulation information for birds
Element 2: Evaluate the practical consequences of the parameters on their work-related tasks.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Determination of constraints, limits and obligations ensuing from the legal framework Methodical review of the protocol and work plan with respect to the legal and ethical parameters Adjustment of logistical and practical aspects under their responsibility Accurate communication of relevant information to the persons concerned 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Distinguish legal and illegal practices related to bird capture and hunting Distinguish national protocols on the capture, handling, and marking of birds from the Canadian Council for Animal Care Distinguish limitations on attracting waterfowl and other species for study inside and outside of National/Provincial Parks Distinguish preparation of oral, visual and written material pertaining to birds during an open house presentation for the public
Element 3: Participate in the application of the laws and regulations that pertain to their field.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Preparation of the forms required to obtain permits and authorizations Adoption of professional practices in 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Identify the legal requirements for obtaining scientific permits for research with birds and the

<p>compliance with laws and regulations</p> <ul style="list-style-type: none"> • Relevant dealings with users of an environment for education purposes 	<p>laws governing harvesting of game species</p> <ul style="list-style-type: none"> • Identify the requirements from an Animal Care Committee the protocols for monitoring birds • Identify the requirements to obtain scientific permits for educational training and research
<p>Element 4: Conduct themselves in an ethical manner in their work-related activities.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Ongoing demonstration of openness to the values and prerogatives of others • Attitude of intellectual honesty at all times • Application of ethical practices • Constant concern for the impact of their practices on organisms and their habitats • Constant concern for the impact of their practices on human communities 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Follow the protocols for capture, handling, and data processing of wild birds • Understand the importance of accuracy in data gathering and bird harvest regulations in species management • Use accepted protocols for the local control for pest and predator species during studies of wildlife bird populations • Follow the protocols to reduce stress and mortality in captured birds • Understand and explain the importance of social, legal and economic impact of bird habitat development on surrounding communities

Course Title	Ecotoxicology
Course Code	145-561-VA
Competencies	<p>0448: To analyze the occupation.</p> <p>0449: To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p> <p>044A: To use digital and computer technologies on the job.</p> <p>044B: To describe the abiotic components of a natural environment.</p> <p>044C: To carry out laboratory analyses.</p> <p>044H: To analyze how animals live in and adapt to their environment.</p> <p>044K: To plan the technical and logistical aspects of an applied research project.</p> <p>044L: To work in a team.</p> <p>044M: To use a variety of field equipment.</p> <p>044N: To apply health and safety measures.</p> <p>044P: To apply wilderness survival techniques.</p> <p>044S: To act within the legal and ethical parameters of the field.</p> <p>044W: To apply intervention measures in a natural environment.</p>
Ponderation	5-5-2
Credits	4
Prerequisites	
Links: Backward	145-111-VA Outlook on the Environment, 202-111-VA General Chemistry, 202-311-VA
Forward	145-651-VA Ecological Cartography, 145-661-VA Environmental G.I.S.
Current Semester	145-531-VA Limnology
<p>Course Description</p> <p>The objectives are to learn the toxic substances in the four environmental compartments (air, soil, water and biotic components).</p> <p>Techniques of analysis, transformations, environmental cycles, and modes of action are also covered. The effects on plant and animal organisms, ecosystems, and human health are examined. The phases are:</p> <p>1) the acquisition of knowledge in ecological toxicology and an initiation to the requirements of the workplace; 2) the application of different techniques and equipment for sampling in the field and laboratory, including safety norms and protocols, 3) data analysis and presentation in technical or laboratory reports; 4) professional responsibilities.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • Using recent information on the occupation and the different work environments • During visits to companies as part of a job-search process • While conducting watershed analyses in an ecological time scale • Based on all the soil, sediment and water samples provided, meteorological data • Using applications related to word and image processing, data processing and the creation of databases • Using applications related to geomatics, cartography and the presentation of data and scientific information • Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects • For all types of research applied to a natural environment, performed in the field or in a lab • For work carried out as part of a disciplinary or multidisciplinary team • In meetings and as part of heterogeneous teams made up of representatives of different users of a given territory • Using various transportation vehicles, watercraft, positioning and communications equipment, and 	<ul style="list-style-type: none"> • In the classroom <ul style="list-style-type: none"> - Lectures - Discussion and case studies - Student handouts • In the lab <ul style="list-style-type: none"> - Equipment preparation for lab and field - Sample analysis and data tabulation • In the Field <ul style="list-style-type: none"> - Biophysical site description - Sample gathering, handling and preservation <p>FIELD TRIPS</p>

<p>equipment and accessories required for field work (characterization, experimental research, land-use planning, etc.)</p> <ul style="list-style-type: none"> • Using the required materials: first-aid kit, protective clothing and equipment, and health and safety facilities • While conducting analyses of samples taken from the field or in the lab • Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects • In accordance with the laws and regulations in effect, in particular the <i>Forest Act</i>, <i>Environment Quality Act</i>, <i>An Act respecting the conservation and development of wildlife</i> and the guidelines developed by the Canadian Council on Animal Care • In accordance with the legal guidelines applicable to the issue of permits and authorizations • Using the required documentation • For a variety of very complex activities that involve experimenting with methods, techniques and approaches, prior to their generalization • As part of multidisciplinary teams and based on studies and research conducted in a natural environment, recommendations and statements formulated as part of these studies as well as the problems and conclusions of these studies • Using all the required documentation, tools, apparatus and equipment 	
<p>Competency 0448: To analyze the occupation.</p>	
<p>Element 4: Analyze the requirements associated with entrepreneurship.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of self-employment opportunities in the sector • Appropriate analysis of strategies for preparing an offer of professional services • Analysis of requirements, constraints and resources related to starting up a business in this sector 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify opportunities leading to self-employment • Collect and analyze resources needed for business start-up
<p>Competency 0449: To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p>	
<p>Element 3: Analyze the factors that influence the main physicochemical properties of fresh- and saltwater environments.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Description of the main physicochemical properties of fresh- and saltwater environments • Explanation of the influence of climate, runoff and currents on the properties of fresh- and saltwater environments 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify the field sampling procedures appropriate to the aquatic site • Measure stream velocity, width, depth • Measure and describe the substrate, aquatic plant and shoreline vegetation cover • Measure physical and chemical constituents of fresh water
<p>Competency 044A : To use digital and computer technologies on the job.</p>	
<p>Element 6: Use the Internet and Intranet for purposes of research and communication.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Effective access to networks • Secure use of functions for sharing files and folders • Efficient use of Web browsers 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use web sources to assist in data interpretation • Search for alternate field sampling/lab analysis techniques • Prepare data tables and a technical report

<ul style="list-style-type: none"> • Compilation of electronic vertical files (directory of sites) relevant to the field 	
<p>Competency 044B : To describe the abiotic components of a natural environment.</p>	
<p>Element 1: Plan the work under his supervision.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points and stations • Determination of the route to be taken in compliance with environmental constraints • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Use GPS and topographical maps to accurately locate sample sites • Estimate the topographical limitations imposed by different sites on safe and accurate sampling • Determine the sequence of field sampling measurements • Take, handle and preserve samples
<p>Element 2: Take samples.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of techniques for sampling water, soils and sediments • Respect defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Optimal accuracy and quality of samples • Appropriate conservation of samples 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Follow establish safety procedures for field sampling and laboratory analysis • Work in a team to maintain a sampling schedule • Follow standard procedures for water sampling, processing, sample preservation and storage • Measure and record supporting field data for sample analysis
<p>Element 3: Analyze samples.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Analysis of all the physical and physicochemical parameters required • Rigorous use of analysis instruments in compliance with prescribed techniques • Good tactile and visual sensitivity 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Prepare chemicals and glassware prior to analysis • Pre-check all field and lab analytical equipment to ensure that it is operational • Use colorimetry to analyze heavy metal concentrations • Record data on standardized sheets • Follow protocols for waste chemical labelling and storage
<p>Competency 044C: To carry out laboratory analyses.</p>	
<p>Element 1: Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • List all the steps to be followed. • Estimate time for each task . • List all the physical and chemical agents to be used and verified if safer and less expensive alternatives can be used. • Follow the health and safety aspects of physical and chemical agents to be used and their health and safety aspects verified using the appropriate MSDS (Material Safety Data Sheet).
<p>Element 2: Perform the preliminary work required for the analyses.</p>	
<p><u>Performance Criteria</u></p>	<p><u>Learning Outcomes</u></p>

<ul style="list-style-type: none"> • Proper assembly, adaptation and calibration of equipment • Accurate calculations for the dilution and concentration of solutions • Accurate conversions of concentration units • Methodical preparation of solutions, using volumetric instruments and the required materials • Preparation and preprocessing of samples according to the types of analysis required 	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Assemble and calibrate equipment. • Calculate solution concentrations and prepare dilute solutions using stock solutions. • Relate various concentration units such as molarity, ppm, % etc. • Process samples.
<p>Competency 044H: To analyze how animals live in and adapt to their environment.</p>	
<p>Element 2: Explain the connections between the characteristics of the animals and their respective habitats.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> ▪ Relevant explanation of the main physiological mechanisms of animals according to their specificities. ▪ Relevant explanation of the role of animals in their respective habitats. ▪ Forecast assessment of the impact of environmental changes on the animals' ability to adapt and survive. 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Assess pollutant concentrations in samples • Compare concentrations to the Canadian Water Quality Guidelines • Compare changes in invertebrate diversity and population numbers relative to different pollution levels
<p>Competency 044K: To plan the technical and logistical aspects of an applied research project.</p>	
<p>Element 1: Analyze the determining parameters of the project.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous analysis of the problem and questions on which the research is based • Clear explanation of the project's objectives and issues • List of all of the project's important determinants, including those related to ethics 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Access past local data on the problem prior to field sampling • Discuss the project goals and objectives • Examine the limitations imposed by equipment, available manpower and study site characteristics
<p>Element 2: Describe the tasks and operations associated with the project.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of relevant tasks and operations • Presentation of the different tasks in a logical sequence • Applicability of the sequence proposed • Optimal management of time allotted 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Relate goals and objectives to availability of time and money for field sampling/lab analysis • Describe sampling sequence and sampling schedule relative to goals and objectives
<p>Element 3: Determine the resources required.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the types and quantities of resources required • Appropriate use of different catalogues • Establishment of an exhaustive list of resources pertaining to lodging, transportation, food, equipment and safety • Establishment of an exhaustive list of materials involved in applying the protocol (technical aspects) 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Compile equipment lists for field sampling and health and safety measures • Participate in a small team; teams will verify that their equipment is clean, prepared and operational
<p>Element 4: Establish how to acquire and transport resources to the work site.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete inventory of resources already in stock • Selection of appropriate suppliers • Determination of acquisition method (lease or buy) according to the available budget 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Inventory resources in stock to complete the project • Prepare lists of needed equipment • Discuss in a group the transport required for equipment

<ul style="list-style-type: none"> • Determination of delivery method according to prescribed deadlines and the sequence of work tasks • Proper preparation of purchase orders • Appropriate planning of purchase and delivery follow-up 	<p>and personnel</p> <ul style="list-style-type: none"> • Arrange a schedule for transport which maintains the field sampling schedule • Ensure that chemicals and glassware for sample preservation after field collection is available
<p>Element 5: Take the legislative framework into account and adjust their planning accordingly.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of all procedures related to laws and regulations in effect • Acquisition of required permits and authorizations • Planning in conformity with laws and regulations in effect 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Confirm that local property owners rights have been respected • Confirm that permission to use the land has been obtained • Confirm that sampling protocols follow established water quality guidelines • Confirm that disposal of waste chemicals follows the accepted norms
<p>Competency 044L : To work in a team.</p>	
<p>Element 1: Exercise positive leadership within a team.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Competent exercise of the role of team leader when the circumstances require it • Balanced, equitable sharing of tasks and responsibilities among team members • Effective management of potentially conflictual situations • Proper leadership provided for tasks to be performed • Openness to constructive criticism • Significant contribution to creating an atmosphere of collaboration and consensus • Formulation of relevant recommendations aimed at improving the effectiveness of the team 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Review and discuss in a group problems and procedures after field sampling • Examine data sheets for completeness of data • Refer data sheets back to other team members for revision of errors or omissions
<p>Element 2: Participate actively in the team effort, taking on their share of responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper preparation of work meetings and their personal participation • Active contribution to achieving the objectives set by the team • Organized presentation of their views on different topics on the agenda • Clear, logical arguments proposed in support of their opinions • Adequate emotional control with respect to interpersonal conflict and diverging opinions 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Distinguish the tasks and time frames for field data collection through group discussions • Identify tasks for small teams and required logistical support to accomplish these • Identify individual tasks within a team and a schedule for rotation of duties
<p>Element 3: Adapt to the people they are working with.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Continued effort to understand the occupational realities of the people they work with and the terminology they use • Accurate understanding of the dynamics among the various persons concerned: <ul style="list-style-type: none"> – determinants related to the specific cultural practices and aspects of the persons concerned – ongoing and completed project activities on the agenda – issues and interests defended by each party 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Rotate through the different tasks during lab analysis to broaden their familiarity with the analyses • Evaluate, as part of a group, the finished data sheets for errors or omissions

<ul style="list-style-type: none"> – quality and history of relationships between the various persons concerned • Adaptation of their language, approach and attitudes to the characteristics of the persons they are working with • Demonstration of a real ability to create a climate conducive to harmonious, productive work within a heterogeneous team 	
<p>Element 4: Establish and maintain proper professional relationships within a team.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Establishment of professional credibility and objectivity with their colleagues and other persons concerned • Adoption of attitudes conducive to maintaining good professional relationships: <ul style="list-style-type: none"> – respect – attentive listening – ethics – rigour • Projection of a polished professional image adapted to the circumstances 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Prepare a technical report based on the results of current field sampling and lab analysis • Have access to previous data from the study sites (wider data base for analysis) • Critique the field performance and lab analysis • Recommend how teamwork could be carried out more efficiently • Recommend methodological improvements for future studies involving teams
<p>Competency 044M : To use a variety of field equipment.</p>	
<p>Element 1: Obtain information on how to operate and maintain various pieces of equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Careful reading of user manuals • Brief explanation of how various pieces of equipment are made and how they work • Development of procedures summarizing how to use the equipment • Preparation of maintenance sheets for the other team members 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Carry out a review of generally accepted procedures for field sampling • Access the manufacturers guidelines for specific sampling equipment
<p>Element 2 : Operate various pieces of equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Thorough verification of equipment prior to use • Application of procedures for adjusting and fine-tuning equipment prior to use • Safe, proper use of equipment • Respect standards and regulations in effect 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Ensure that all equipment is operational prior to field use • Calibrate laboratory equipment prior to analysis • Ensure that all necessary data sheets and sample labelling material is prepared
<p>Element 3: Perform routine and preventive maintenance on the equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Respect for the inspection schedule recommended by the manufacturer • Adequate use of basic techniques: <ul style="list-style-type: none"> – removal and installation of certain components – lubrication – routine adjustments – replacement of various parts • Safe use of tools and products required for maintenance • Proper maintenance of equipment for storage purposes 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Verify that field/lab equipment has been cleaned, adjusted and pre-checked for accuracy • Verify that equipment has been cleaned and repaired prior to storage after sampling and analysis
<p>Element 4: Apply troubleshooting methods in the event of equipment breakdown.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate identification of the nature and scope of the problem • Effective solution of the problem 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Troubleshoot standard problems associated with field and laboratory equipment

<ul style="list-style-type: none"> • Ability to work independently, and to be resourceful and innovative 	<ul style="list-style-type: none"> • Have radio communication with the college supervisors for problems in the field • Carry extra sample gathering material in the event of unanticipated problems
<p>Element 5: Adapt and make various accessories and equipment.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adaptation of various existing equipment to the working conditions • Fabrication of customized equipment, accessories and tools adapted to specific needs • Ability to work independently, and to be resourceful and innovative 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Determine how much extra sampling equipment to take as backup • Adapt existing equipment to deal with safety concerns at individual sites
<p>Competency 044N: To apply health and safety measures.</p>	
<p>Element 1 : Recognize the potential risks in a lab and in the field.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate distinction of the different types of risks: <ul style="list-style-type: none"> – environmental factors – factors related to the types of tasks, including handling and containing a variety of organisms – factors related to the use of products, apparatus and equipment – factors related to attitudes and general behaviours • Careful observation and accurate interpretation of signs of potential danger • Realistic assessment of the degree of danger involved in various risky situations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Determine health and safety risks at individual sites imposed by terrain conditions • Distinguish the health risks associated with sampling for particular pollutants • Ensure that proper safety gear is in use during field sampling
<p>Element 2 : Apply the necessary health and safety preventive measures.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate understanding of the site evacuation plan • Accurate location of equipment and identification of resource persons in the event of an emergency • Verification that all health and safety materials are accessible and in good working order • Development of materials according to the weaknesses observed • Adoption of safe behaviours and attitudes in all circumstances • Rigorous application of preventive measures with respect to: <ul style="list-style-type: none"> – handling organisms – using hazardous products – using equipment 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use field radios to communicate problems to college personnel • Use field first aid and have access to a medical emergency kit • Carry the appropriate protective gear for sampling • Follow the norms regarding safe handling and disposal of chemicals during lab analysis
<p>Element 3 : Take action in an emergency or in the event of an accident on the work site.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Full knowledge of their obligations and responsibilities • Application of emergency measures with level headedness and according to established procedures • Proper administration of first aid in the field and in the lab 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Be certified in field first aid and CPR prior to field work • Use radio communication for field emergencies • Locate all safety and emergency equipment in the lab • Quickly access emergency phone numbers

<ul style="list-style-type: none"> • Effective organization of procedures for evacuating injured persons • Prompt communication with the appropriate authorities 	
Competency 044P: To apply wilderness survival techniques.	
Element 1: Apply the necessary preventive measures in a natural environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Recognition of the sources of potential danger according to the types of tasks and the conditions for performing them • Establishment of an emergency plan • Preparation of all necessary materials • Communication of adopted measures to the persons concerned 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Prepare and carry a field survival pack • Post their location on a central map prior to field work • Estimate the time of return from field work • Plan an emergency escape route if lost
Element 2: Find their bearings in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of landmarks in order to determine their position • Determination of cardinal points based on clues in the environment • Determination of the direction required for their return 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use GPS in the field • Enter GPS data onto GIS software for site locations • Interpret topographical maps • Perform basic orienteering with compasses
Element 3: Find food in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of edible species • Application of techniques for capturing animal species • Lighting of fire • Location of a source of drinking water 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify plants in the field • Access information on local edible plant species and plant parts by seasonal availability • Carry emergency food supplies, matches, snare wires, fish line and hooks and a basic medical kit and a survival pack • Apply tincture of iodine to purify water
Element 4: Find shelter in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate construction of a temporary shelter • Adequate protection against wind, cold and rain 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Access information on constructing emergency shelters • Use ground sheets and space blankets • Use knives, snare wire and fish line to construct shelters
Element 5: Adopt appropriate attitudes and behaviours in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Demonstration of self-control and level headedness • Ability to work independently and to be resourceful • Effective management of factors that could compromise their survival: <ul style="list-style-type: none"> – pain – cold – thirst – hunger – fatigue – boredom and isolation – hazards of all kinds 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Plan for an emergency situation • Have sufficient emergency supplies to overnight in the field • Access medical gear to treat or transport injured personnel • Use CPR and field first aid
Element 6: Manage the factors that could contribute to the survival of a group.	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper, methodical organization of group members • Optimal use of each member's skills • Realistic study of the situation and demonstration of decision making appropriate to the circumstances • Quick reflexes and ability to apply survival skills 	<p><u>Learning Outcomes</u></p> <p>Students will be:</p> <ul style="list-style-type: none"> • Be certified in field first aid and CPR prior to field work • Able to apply emergency procedures and distress signals
<p>Competency 044S: To act within the legal and ethical parameters of the field.</p>	
<p>Element 1: Learn about the legal and ethical parameters that apply to various work-related situations.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of the different aspects of the protocol affected by these parameters • Determination of the authorities, laws and regulations concerned • Identification and consultation of relevant information sources 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify relevant information sources • Consult and obtain information on appropriate legal and ethical parameters in a give situation
<p>Element 2: Evaluate the practical consequences of the parameters on their work-related tasks.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of constraints, limits and obligations ensuing from the legal framework • Methodical review of the protocol and work plan with respect to the legal and ethical parameters • Adjustment of logistical and practical aspects under their responsibility • Accurate communication of relevant information to the persons concerned 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Establish the work plan within the established legal and ethical parameters • Communicate the information accurately
<p>Element 3: Participate in the application of the laws and regulations that pertain to their field.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Preparation of the forms required to obtain permits and authorizations • Adoption of professional practices in compliance with laws and regulations • Relevant dealings with users of an environment for education purposes 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Complete paperwork to obtain permits • Adopt laws and regulations pertinent to the professional practices
<p>Element 4: Conduct themselves in an ethical manner in their work-related activities.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Ongoing demonstration of openness to the values and prerogatives of others • Attitude of intellectual honesty at all times • Application of ethical practices • Constant concern for the impact of their practices on organisms and their habitats • Constant concern for the impact of their practices on human communities 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Work as part of a team • Apply ethical practices
<p>Competency 044W: To apply intervention measures in a natural environment.</p>	
<p>Element 1: Participate in preliminary tasks leading to the development of an action plan.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous analysis of the problem, its nature, and the objectives and issues related to the project • Active participation in determining the goals, objectives and action strategies • Active participation in establishing priorities, a 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Review past local data done on a pollution problem • Discuss the limitations imposed by equipment, time, money and personnel • Work within small teams to achieve the goals and

<p>timetable and the sharing of responsibilities</p> <ul style="list-style-type: none"> • Determination, as a team, of the indicators for monitoring and evaluating the tasks 	<p>objectives</p> <ul style="list-style-type: none"> • Prepare a technical report with management recommendations
<p>Element 2: Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational, material, technical and logistical means as well as the conditions for implementing them • Respect for budget constraints • Respect for time constraints related to the types of measures to be implemented • Obtaining of permits and negotiation of agreements and authorizations • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students, individually or as part of a team, will be able to:</p> <ul style="list-style-type: none"> • Calculate the time necessary for field sampling • Discuss the health and safety factors imposed by the topography of the site • Plan a sampling sequence to meet the goals • Prepare the needed material for sampling and health and safety concerns • Notify landowners prior to sampling
<p>Element 3: Begin the work in the field.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate delineation of work site(s) • Verification to ensure that everyone concerned understands the work instructions • Distribution of tasks and responsibilities among team members 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Determine site location via GPS • Arrange teamwork so that team members participate in all the different tasks • Ensure that the sampling schedule is maintained • Complete field handling and storage of samples • Complete a biophysical site description
<p>Element 4: Coordinate the work.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Coordination and monitoring of the progress of the work according to predefined indicators • Adequate use of work techniques associated with the measures to be implemented • Quality of the work • Safe execution of the work • Application of appropriate adjustments while carrying out the work • Production of a complete technical report 	<p><u>Learning Outcomes</u></p> <p>Students, individually and as part of a team, will be able to:</p> <ul style="list-style-type: none"> • Communicate with college personnel and other teams to assess sampling progress • Complete field data sheets to professional standards • Adequately handle, label, store and preserve samples to prevent degradation • Produce individual technical reports based on survey results and previous data
<p>Element 5: Evaluate the results obtained.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Medium- and long-term monitoring of the various predefined indicators • Description of the results obtained • Proposal of corrective actions in the case of unsatisfactory results 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Evaluate whether sampling was adequate to meet the objectives • Determine whether toxicant levels fell within acceptable government regulated guidelines • Make recommendations for future study of the problem to increase the database

Course Title	Mammal Management
Course Code	145-611-VA
Competencies	004H: To analyze how animals live in and adapt to their environment. 044L: To work in a team. 044M: To use a variety of field equipment. 044N: To apply health and safety measures. 044Q: To describe the biotic of a fresh- or saltwater environment. 004R: To describe the biotic components of a terrestrial environment. 044S: To act within the legal and ethical parameters of the field.
Ponderation	1-4-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-311-VA Ecology, 101-321-VA Vertebrate Form and Function 2, 145-311-VA Vertebrate Taxonomy
Forward	NA
Current Semester	145-651-VA Ecological Cartography, 145-661-VA Environmental G.I.S.
Course Description	
<p>The objectives are to familiarize the student with the equipment, methods and techniques of inventory, conservation, use and management of mammal populations and their habitats. Lecture, laboratory, and field material cover the factors affecting the types of equipment and sampling plans used in the study of mammals, equipment maintenance and repair, data analysis and indices of age, sex, health, productivity, and survival. Other aspects cover the techniques of measuring the availability and utilization of food and cover, habitat maintenance and improvement methods, and population estimates using both direct (e.g., mark and recapture) and indirect (e.g., aerial surveys) methods. The legislation governing hunting, trapping, and other activities with mammals is discussed.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • Working on research that involves characterizing biotic and abiotic resources in natural and controlled environments • While conducting analyses related to organisms • Based on live specimens (in captivity or free-ranging) or dead specimens; specimens that have been given to or collected by the technician; information on the environment and the living conditions of animals; as well as established research protocols • Using the required apparatus, lab tests, observation equipment, documentation, procedures and databases • For all types of research focusing primarily on ecosystem characterization, including conservation and restoration • Working alone or in a team, with supervision and complying with all ethical considerations • Using defined or standardized methods and protocols; provided soil, water or organism samples; information on the environment and conditions for breeding and preserving organisms; a predetermined budget as well as predetermined formats for data input • Using the required documentation and procedures, apparatus, instruments, tools and facilities as well as all the means related to logistical aspects 	<ul style="list-style-type: none"> • In the classroom <ul style="list-style-type: none"> - Lectures - Handouts - Textbooks - Reference collections of biological materials - Discussion • In the lab <ul style="list-style-type: none"> - Taxonomic keys for identification - Biological reference material - Age/sex criteria for specific mammal groups • In the field <ul style="list-style-type: none"> - Field trips – observation - Field trips - sampling

<ul style="list-style-type: none"> • For work carried out as part of a disciplinary or multidisciplinary team • In meetings and as part of heterogeneous teams made up of representatives of different users of a given territory • For all types of activities performed in a natural environment • Using various transportation vehicles, watercraft, positioning and communications equipment, and equipment and accessories required for field work (characterization, experimental research, land-use planning, etc.) • Using the required materials: manufacturers' manuals in English and French, tools and products required for the routine maintenance of vehicles, watercraft and equipment; capturing, measuring, listening and general inventory materials • For all types of activities performed in a natural environment and in a lab • Using the required documentation • Using the required materials: first-aid kit, protective clothing and equipment, and health and safety facilities • For all types of research involving ecosystem characterization • Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a deadline and a predetermined budget as well as predetermined formats for data input • While conducting analyses of samples taken from the field or in the lab • Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects • For all work-related activities • In accordance with the laws and regulations in effect, in particular the <i>Forest Act, Environment Quality Act, An Act respecting the conservation and development of wildlife</i> and the guidelines developed by the Canadian Council on Animal Care • In accordance with the legal guidelines applicable to the issue of permits and authorizations • Using the required documentation 	
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Competency 044H: To analyze how animals live in and adapt to their environment.

Element 3: Study the habits and behaviours of animals.

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> ▪ Adaptation of observation protocols according to the type of study and its conditions. ▪ Respect the requirements associated with applying protocols. ▪ Rigorous, methodical collection of all relevant information. ▪ Complete, accurate and precise description of the habits and behaviours of animals in terms of how they use their respective habitats. 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Define the materials required for live trapping of small mammals • Use the protocols approved by an Animal Care Committee • Maintain a schedule of daily field trapping • Relate the species and numbers of small mammals to different habitat characteristics • Complete field data sheets for mammal species, age, sex, breeding condition
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	<ul style="list-style-type: none"> • Apply tags or colouration to individually marked mammals • Distinguish different attractants (baits, scents, lures) used for specific mammal groups
Competency 044L: To work in a team.	
Element 1: Exercise positive leadership within a team.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Competent exercise of the role of team leader when the circumstances require it • Balanced, equitable sharing of tasks and responsibilities among team members • Effective management of potentially conflictual situations • Proper leadership provided for tasks to be performed • Openness to constructive criticism • Significant contribution to creating an atmosphere of collaboration and consensus • Formulation of relevant recommendations aimed at improving the effectiveness of the team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Lead teams of inexperienced students in field checks of trap lines • Arrange work schedules to share responsibilities based on available manpower • Maintain daily logs of field visits • Assist peers with data recording, aging, sexing, and individual marking of small mammals
Element 2: Participate actively in the team effort, taking on their share of responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper preparation of work meetings and their personal participation • Active contribution to achieving the objectives set by the team • Organized presentation of their views on different topics on the agenda • Clear, logical arguments proposed in support of their opinions • Adequate emotional control with respect to interpersonal conflict and diverging opinions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Instruct inexperienced students in field techniques and mammal identification • Adjust schedules of field work to available manpower • Discuss problems related to field work in a group context
Element 3: Adapt to the people they are working with.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Continued effort to understand the occupational realities of the people they work with and the terminology they use • Accurate understanding of the dynamics among the various persons concerned: <ul style="list-style-type: none"> – determinants related to the specific cultural practices and aspects of the persons concerned – ongoing and completed project activities on the agenda – issues and interests defended by each party – quality and history of relationships between the various persons concerned • Adaptation of their language, approach and attitudes to the characteristics of the persons they are working with • Demonstration of a real ability to create a climate conducive to harmonious, productive work within a heterogeneous team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Participate in group discussion sessions • Exchange views with peers on problems relating to field work or field station operations • Express individual opinions on emerging problems • Arrive at a group consensus for problem resolution
Competency 044M : To use a variety of field equipment.	

Element 1: Obtain information on how to operate and maintain various pieces of equipment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Careful reading of user manuals Brief explanation of how various pieces of equipment are made and how they work Development of procedures summarizing how to use the equipment Preparation of maintenance sheets for the other team members 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Access handouts on the preparation, care and maintenance of field capture equipment Set up and use a variety of field traps including box traps for live capture, specialized beaver traps, leg-hold traps, body-grip traps, snares and snap-traps
Element 2 : Operate various pieces of equipment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Thorough verification of equipment prior to use Application of procedures for adjusting and fine-tuning equipment prior to use Safe, proper use of equipment Respect standards and regulations in effect 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Check live-traps for defects prior to field operations Clearly mark trap lines to prevent trap loss Respect Animal Care Committee norms for mammal trapping, handling and marking
Element 3: Perform routine and preventive maintenance on the equipment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Respect for the inspection schedule recommended by the manufacturer Adequate use of basic techniques: <ul style="list-style-type: none"> removal and installation of certain components lubrication routine adjustments replacement of various parts Safe use of tools and products required for maintenance Proper maintenance of equipment for storage purposes 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Use tools to make routine adjustments (doors, spring mechanisms) to increase trap efficiency Apply the techniques of rust/oil removal, colouration and waxing of commercial fur traps Discover proper storage procedures of traps to prevent damage or contamination
Element 4: Apply troubleshooting methods in the event of equipment breakdown.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Accurate identification of the nature and scope of the problem Effective solution of the problem Ability to work independently, and to be resourceful and innovative 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Make trap adjustments in the field to increase efficiency Carry tools and sufficient spare bait, nesting materials and extra traps to replace lost or damaged traps
Element 5: Adapt and make various accessories and equipment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Adaptation of various existing equipment to the working conditions Fabrication of customized equipment, accessories and tools adapted to specific needs Ability to work independently, and to be resourceful and innovative 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Make minor repairs on field traps Replace defective traps Cannibalize broken traps for spare parts Rebuild lightly damaged traps

Competency 044N: To apply health and safety measures.	
Element 1 : Recognize the potential risks in a lab and in the field.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate distinction of the different types of risks: <ul style="list-style-type: none"> – environmental factors – factors related to the types of tasks, including handling and containing a variety of organisms – factors related to the use of products, apparatus and equipment – factors related to attitudes and general behaviours • Careful observation and accurate interpretation of signs of potential danger • Realistic assessment of the degree of danger involved in various risky situations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Mark field study locations on a large-scale map prior to field work • Distinguish disease and health risks in handling various animal groups • Determine health and safety risks at individual sites imposed by terrain conditions • Ensure that proper safety gear is in use during field sampling and mammal handling
Element 2 : Apply the necessary health and safety preventive measures.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate understanding of the site evacuation plan • Accurate location of equipment and identification of resource persons in the event of an emergency • Verification that all health and safety materials are accessible and in good working order • Development of materials according to the weaknesses observed • Adoption of safe behaviours and attitudes in all circumstances • Rigorous application of preventive measures with respect to: <ul style="list-style-type: none"> – handling organisms – using hazardous products – using equipment 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use field radios to communicate problems to college personnel • Use field first aid and have access to a medical emergency kit • Carry the appropriate protective gear for sampling • Apply proper cleaning and sterilising techniques prior to storage of traps
Element 3 : Take action in an emergency or in the event of an accident on the work site.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Full knowledge of their obligations and responsibilities • Application of emergency measures with level headedness and according to established procedures • Proper administration of first aid in the field and in the lab • Effective organization of procedures for evacuating injured persons • Prompt communication with the appropriate authorities 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Get Certification in field first aid and CPR prior to field work • Able to use radio communication for field emergencies • Locate of all safety and emergency equipment in the lab • Quickly access emergency phone numbers
Competency 044Q: To describe the biotic of a fresh- or saltwater environment.	
Element 2 : Take inventories	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of inventory methods • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Accuracy and quality of information gathered, 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify valuable aquatic furbearers • Identify field sign (browse, huts, territorial scent posts, scats) left by specific furbearer groups • Use live traps to relocate pest animals • Use a variety of snares, leg-hold and body-grip traps

<p>in particular with respect to:</p> <ul style="list-style-type: none"> – identifying the species present – counting the species present – delineating the distribution areas of the species present 	<p>used for aquatic furbearers</p> <ul style="list-style-type: none"> • Determine effective trap locations relative to the behaviour of the species • Use attractants such as baits and scents
<p>Competency 044R: To describe the biotic components of a terrestrial environment.</p>	
<p>Element 2 : Plan the work under their responsibility</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the tasks • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points • Determination of the route to be taken in compliance with environmental constraints • Respect for budget constraints • Respect for time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Determine the amount of field data necessary to meet the project goals • Determine trapping schedules required to meet Animal Care Committee standards • Locate trap line positions using GPS or topographical map coordinates • Describe the trap line habitat type • Maintain a daily log and complete standardized field capture sheets • Follow appropriate health and safety protocols • Determine the appropriate criteria and equipment for aging/sexing/markings of individual mammal species • Use proper mammal handling techniques to help minimize stress
<p>Competency 044S: To act within the legal and ethical parameters of the field.</p>	
<p>Element 1: Learn about the legal and ethical parameters that apply to various work-related situations.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of the different aspects of the protocol affected by these parameters • Determination of the authorities, laws and regulations concerned • Identification and consultation of relevant information sources 	<p><u>Learning Outcomes</u> The student will be able to;</p> <ul style="list-style-type: none"> • Distinguish the scientific licences necessary for mammal studies • Apply the proper Animal Care Committee protocols for capture, handling and marking of mammals
<p>Element 2: Evaluate the practical consequences of the parameters on their work-related tasks.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of constraints, limits and obligations ensuing from the legal framework • Methodical review of the protocol and work plan with respect to the legal and ethical parameters • Adjustment of logistical and practical aspects under their responsibility • Accurate communication of relevant information to the persons concerned 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Distinguish the types of field equipment for trapping sanctioned by national and international treaties • Distinguish the regulations controlling the commercial fur trade on registered and non-registered trap lines • Apply the proper standard for safe handling of firearms • Discover the procedures for training and licencing hunters and commercial fur trappers • Describe the government monitoring and control of the fur harvest and game hunting
<p>Element 3: Participate in the application of the laws and regulations that pertain to their field.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Preparation of the forms required to obtain permits and authorizations • Adoption of professional practices in compliance with laws and regulations • Relevant dealings with users of an environment for education purposes 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Define the professional requirements for obtaining scientific, commercial and recreational licences involving wildlife • Summarize the protocols prior to field work (notification of local wildlife agencies) • Describe the accords reached with local landowners

Element 4: Conduct themselves in an ethical manner in their work-related activities.

Performance Criteria

- Ongoing demonstration of openness to the values and prerogatives of others
- Attitude of intellectual honesty at all times
- Application of ethical practices
- Constant concern for the impact of their practices on organisms and their habitats
- Constant concern for the impact of their practices on human communities

Learning Outcomes

Students will be able to:

- Follow the norms established by an Animal Care Committee and government wildlife agencies
- Contact local landowners prior to field work
- Return the study site to its natural condition upon completion of the work

Course Title	Plant Inventory
Course Code	145-621-VA
Competencies	044A: To use digital and computer technologies on the job. 044M: To use a variety of field equipment 004Q: To describe the biotic components of a fresh- or saltwater environment. 004R: To describe the biotic components of a terrestrial environment.
Ponderation	1-4-2
Credits	2 1/3
Prerequisites	
Links: Backward	101-211-VA Botany, 145-511-VA Plant Taxonomy
Forward	NA
Current Semester	None
Course Description	
<p>The factors affecting the choice of methods for plant inventory and data analysis in aquatic and terrestrial habitat are covered in lectures, laboratory, and in the field. The material covers reconnaissance versus vegetative analysis-style techniques, random versus systematic sampling and plot versus plotless techniques. Qualitative characteristics such as sociability and vitality are included. The use of different species as environmental indicators is shown. The ecological functioning and role of aquatic macrophytes will also be reviewed.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
For all work-related tasks Using applications related to word and image processing, data processing and the creation of databases <ul style="list-style-type: none"> Using applications related to geomatics, cartography and the presentation of data and scientific information Working alone or in a team of research involving ecosystem characterization Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects 	<ul style="list-style-type: none"> In class <ul style="list-style-type: none"> Lectures Handouts Text books Discussions In the lab <ul style="list-style-type: none"> Data sampling Data recording Use of computers In the field <ul style="list-style-type: none"> Field trips – observation Field trips - sampling
Competency 044A: To use digital and computer technologies on the job.	
Element 6: Use the Internet and Intranet for purposes of research and communication.	
Performance Criteria	Learning Outcomes
<ul style="list-style-type: none"> Effective access to networks Secure use of functions for sharing files and folders Efficient use of Web browsers Compilation of electronic vertical files (directory of sites) relevant to the field 	Students will be able to: <ul style="list-style-type: none"> Use the internet for research topics in plant ecology, management and control
Competency 044M: Use of different field equipment	
Element 1: Gather all information pertaining to the proper use and maintenance of various field equipment	
Performance Criteria	Learning Outcomes
<ul style="list-style-type: none"> Careful observation of owner's manuals Minimal explanation of working and construction principles of the different equipment used 	Students will be able to: <ul style="list-style-type: none"> Use manuals associated with the operation of chainsaws, axes, bow saws, machetes and forestry tapes

<ul style="list-style-type: none"> • Production of methods summarizing the use of different gear • Preparation of maintenance schedules for co-workers 	
Element 2: Work with field equipment	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Meticulous verification of the item prior to use • Application of tuning and adjustment procedures prior to the use of equipment • Safe and adequate use of equipment • Respect of rules and regulations in effect 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Sharpen and clean equipment prior to field work • Identify and use the appropriate maintenance tools • Use the appropriate safety clothing, helmets and ear protectors with chain saws • Apply the safest and most efficient cutting techniques
Element 3: Ensure the preventive and routine maintenance of field equipment	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Respect of manufacturer's recommended maintenance schedule • Sufficient knowledge of basic techniques such as the removal and fastening of parts, lubrication, tuning and parts replacement • Safe use of tools and products required for maintenance • Adequate preparation of equipment destined for storage 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Strip down chain saws for cleaning, adjustment, lubrication and sharpening • Use a bench grinder, metal files and whetstones to sharpen blades • Apply proper handling and storage techniques for equipment
Element 4: Apply troubleshooting measures in case of unforeseen breakdown	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate identification of the nature and scope of the problem • Effective solution of the problem • Ability to work independently, and to be resourceful and innovative 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify the most common problems associated with forestry equipment • Do basic adjustments and repairs
Competency 044Q: To describe the biotic components of a fresh- or saltwater environment.	
Element 1: Plan the work under their responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the tasks • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points and stations • Determination of the route to be taken in compliance with environmental constraints • Respect for budget constraints • Respect for time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use GPS for sample locations • Determine the equipment needed for sampling • Respect time and budget constraints while sampling
Competency 044R: To describe the biotic components of a terrestrial environment.	
Element 1: Plan the work under their responsibility.	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the tasks • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points • Determination of the route to be taken in compliance with environmental constraints • Respect for budget constraints • Respect for time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use topographical maps, GIS data and aerial photographs to locate different plant associations • Use GPS to determine field locations • Determine the safest route to study sites • Use survival packs • Determine sampling equipment required in various habitats
<p>Element 2: Take inventories.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of inventory methods • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Accuracy and quality of information gathered, in particular with respect to: <ul style="list-style-type: none"> • identifying the species present • counting the species present • delineating the distribution areas of the species present 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Distinguish between reconnaissance and vegetative analysis-type techniques • Examine the effects of plot size, shape and number of plots on data accuracy • Use plot and plotless techniques to establish the frequency, density and cover of individual species • Use indicator plant species to show changes in climate, soil fertility, drainage and past disturbance • Contrast the advantages/disadvantages of random versus systematic sampling
<p>Element 3: Take samples.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of techniques for sampling organisms or parts of organisms • Respect for defined protocols • Ability to work independently in order to adapt the methods and techniques used to specific environmental constraints • Optimal accuracy and quality of samples • Appropriate conservation of samples 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Take field samples of plant material with temporary preservation • Relate plant species to variations in topographical relief, drainage, soil fertility and past disturbance

Course Title	Internship
Course Code	145-631-VA
Competencies	0448 : To analyze the occupation. 044E: To convey scientific information.
Ponderation	0-10-2
Credits	4
Prerequisites	
Links: <i>Backward</i>	145-411-VA Ecological Research Techniques
<i>Forward</i>	NA
<i>Current Semester</i>	Any 5 th or 6 th semester course, dependant on the internship
Course Description	
<p>The objectives are to allow the student to apply the techniques acquired from his/her training in the work milieu and develop a better perspective of the skills, techniques and qualities required in the job market. The student will become part of the work teams in private, public or educational agencies to familiarize himself/herself with the norms and practices that are carried out by technologists in the environment. The student in the laboratory or field is under the joint supervision and evaluation of a teacher/supervisor from the college and of an individual from the internship workplace. The internship period covers three phases: initiation to the job market and training for the tasks to be accomplished, apprenticeship in different techniques and an introduction to the professional responsibilities, and submission of an essay upon completion of the internship.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> Using recent information on the occupation and the different work environments During visits to companies as part of a job-search process For purposes of interpretation and training, scientific popularization and the production of scientific materials, including technical reports and parts of research reports Based on specific requests and expressed or perceived information needs Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer equipment and any other appropriate apparatus For activities that involve land-use planning measures, in particular, related to attenuation, restoration, recovery and compensation As part of multidisciplinary teams and based on studies and research conducted in a natural environment, recommendations and statements formulated as part of these studies as well as the problems and conclusions of these studies Using all the required documentation, tools, apparatus and equipment 	<ul style="list-style-type: none"> In the classroom <ul style="list-style-type: none"> Lectures (resumés, job hunting strategies) In the workplace <ul style="list-style-type: none"> Introduction to workplace dynamics Completion of tasks performed by technologists
Competency 0448: To analyze the occupation.	
Element 1 : Describe the occupation and the conditions under which it is practised.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>
<ul style="list-style-type: none"> Relevant information gathered Thorough analysis of the general characteristics of the occupation and the conditions for practising the occupation 	<p>Students will be able to:</p> <ul style="list-style-type: none"> Examine the types of tasks performed by technologists Participate in the workplace dynamics

<ul style="list-style-type: none"> • Identification of the different work environments • Identification of the different career options 	<ul style="list-style-type: none"> • Interact with tutors, other internship centre staff and/or the public • Work as part of a team • Work independently on projects • Identify job opportunities related to the field • Create resumés designed for specific job sectors • Identify job hunting strategies
<p>Element 2 : Analyze the tasks and operations related to the occupation.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Appropriate analysis of the tasks and operations, the conditions under which they are carried out and the criteria associated with each of them • Accurate assessment of the relative importance of each task • Relationship established between the steps in the work process and the occupational tasks 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Describe the internal organization of the internship centre • Apply appropriate safety procedures • Receive practical training under supervision • Become familiar with the methods, instruments and procedures of the internship centre
<p>Element 3 : Analyze the skills and behaviours required to practise the occupation</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant connections between skills and behaviours, on the one hand, and the occupational tasks, on the other • Identification of professional rules of ethics 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Determine the skills and personal abilities required to complete tasks in the work milieu • Identify the norms of quality control associated with the tasks performed • Carry out duties in a professional manner
<p>Competency 044E: To convey scientific information.</p>	
<p>Element 1 : Describe the different target audiences</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Thorough analysis of the target audience's needs and characteristics • Accurate establishment of the target audience profile 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Interact at a professional level with co-workers and/or the public • Establish the requirements for a working technologist in the field • Convey information suited to the knowledge/abilities of the target audience

Course Title	Research Project	
Course Code	145-241-VA	
Competencies	044A: To use digital and computer technologies on the job. 044B: To describe the abiotic resources of a natural environment. 043W: To establish the profile of a situation using statistics. 044E: To convey information about a natural environment. 044K: To plan the technical and logistical aspects of an applied research project. 044L: To work in a team. 044P: To apply wilderness survival techniques. 044R: To describe the biotic components of a terrestrial environment. 044T: To conduct an ecosystemic analysis of a territory. 044U: To apply the scientific approach to problem-solving.	
Ponderation	1-3-2	
Credits	2	
Prerequisites		
Links: Backward	145-411-VA Ecological Research Techniques	
<i>Forward</i>	NA	
<i>Current Semester</i>	145-651-VA Ecological Cartography, 145-661-VA Environmental G.I.S, any other 5 th or 6 th semester course, dependant on the project	
Course Description		
<p>The student will participate in class discussions and the formulation of project objectives and definitions. The emphasis is on devising and conducting a scientific investigation. Students will work in small teams which will then pool data to give a more comprehensive overview of the subject under study. Experience will be gained in formulating scientific objectives, selecting and utilizing appropriate methodologies, collecting data, conducting analyses and generating conclusions. The results will be presented in individual student technical reports.</p>		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
<ul style="list-style-type: none"> • For all work-related tasks • Using applications related to word and image processing, data processing and the creation of databases, and all other computer tools • Using applications related to geomatics, cartography and the presentation of data and scientific information • For all types of research involving ecosystem characterization • Working alone or in a team, with supervision and based on established or standardized research protocols, defined methods, a predetermined budget as well as predetermined formats for data input • Analyzing samples taken in the field or in the lab • Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects • For activities carried out in a natural environment: research, land-use planning, resource management, etc. • Under the supervision of the project coordinator • Based on raw or preprocessed data pertaining to the main aspects of the situation under study, a previously formulated working hypothesis and a general description of the situation 		<ul style="list-style-type: none"> • In the classroom <ul style="list-style-type: none"> - Lectures - Class handouts • In the lab <ul style="list-style-type: none"> - Sample analysis - Data tabulation and presentation • In the field <ul style="list-style-type: none"> - Field trips - sampling

- Using the required tools, including appropriate software and any necessary documentation
- For purposes of interpretation and training, scientific popularization and the production of scientific materials, including technical reports and parts of research reports
- Based on specific requests and expressed or perceived information needs
- Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer equipment and any other appropriate apparatus
- For all types of research applied to a natural environment, performed in the field or in a lab
- Working alone or in a team, with supervision and based on a predefined research protocol, a general description of the tasks to be performed, a predetermined budget and a timetable
- Using the required documentation pertaining to purchases, permits and authorizations, as well as appropriate computer tools and a list of suppliers
- While conducting analyses of samples taken from the field or in the lab
- As part of a team, with supervision and under the aegis of public, parapublic or private authorities, and working in terrestrial, fresh- and saltwater environments
- While performing tasks for purposes of characterizing an environment, establishing master plans and action plans, evaluating the impact of various activities on the environment as well as possibly carrying out interpretation and education activities, etc.
- Based on guidelines pertaining to a clearly defined problem: population dynamics, condition of a habitat; the planning, use and conservation of resources; impact studies, etc.
- Preparing a summary using all the studies on the environment in question and all the required data, in particular georeferenced and thematic maps, databases, research and inventory reports
- For research conducted alone, under supervision and in the field and in a lab
- Based on concrete study, analysis and intervention situations where problems require that lab protocols and methods be adjusted or modified or that practices for intervening in the natural environment be modified according to specific conditions and constraints
- Taking into consideration predetermined time and budget constraints
- Using the required scientific and technical documentation, tools, computer applications, equipment, apparatus and products
- For a variety of very complex activities that involve experimenting with methods, techniques and approaches, prior to their generalization
- Based on specific instructions, defined experimental research protocols and methods, a predetermined budget as well as predetermined formats for data input

Competency 044A: To use digital and computer technologies on the job.	
Element 3: Use computerized tools for statistical processing and data representation	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Design of relevant computerized worksheets useful for collecting and inputting data • Determination of a worksheet and file format adapted to the study parameters and their specific context • Validation of whether the worksheets are functional • Correct inputting of data provided • Use of basic functions related to the application's statistical processing • Use of basic functions related to the creation of pivot tables and the production of graphs • Correct transfer of data to a database • Formulation of queries in order to use the database 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use computers for preparation of tables • Generate figures • Contrast data sets to estimate accuracy
Element 4: Use geomatics tools and georeferenced maps.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Given existing maps and corresponding files, proper use of the functions for extracting data in order to represent certain aspects of a problem • Addition of data to existing maps in order to modify or update them, or to add supplemental information • Accurate interpretation of georeferenced maps 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use GIS generated maps to record more detailed field data • Use topographical maps and compasses for field surveys
Element 5: Use a variety of digital equipment for image processing.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of a digital camera, camcorder and scanner • Transfer of data from a GPS system to a computerized system • Inputting and basic processing of a variety of images • Importing and integration of digital images in different types of files 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Record sample sites using GPS coordinates • Transfer GPS coordinates onto GIS maps • Cross reference GPS locations with field survey methods
Competency 044B: To describe the abiotic components of a natural environment.	
Element 1: Plan the work under their responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points and stations • Determination of the route to be taken in compliance with environmental constraints • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • List the steps to be followed • Estimate the time for each task • List the elements to be recorded (soil, drainage, relief) • Follow the norms for safe conduct of field work
Competency 043W: To establish the profile of a situation using statistics.	
Element 1: Input data using a computer	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formulation of appropriate queries according to the database • Proper use of appropriate applications, including formatting a spreadsheet • Complete, accurate data input 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Standardize definitions of the biota being measured to facilitate data comparisons • Do computer entry of data from different field techniques
<p>Element 5: Format and present the data in graph form</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of the most appropriate form of graphic presentation • Quality of the tables: <ul style="list-style-type: none"> – relevance of data presented – consideration of appropriate parameters (format, organization and legibility to facilitate interpretation) • Quality of the figures: <ul style="list-style-type: none"> – presentation of highlights – conformity with presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Examine the presentation formats for graphical presentation. • Select the technique which highlights the data being presented, following the protocols for technical presentation. • Prepare tables to allow rapid retrieval of data and data interpretation by the user.
<p>Competency 044E: To convey scientific information.</p>	
<p>Element 2: Determine the objectives, approach and content of the communications</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate, relevant objectives defined • Methodical, effective review of literature on the subject • Selection of content based on relevance to objectives pursued • Determination of a communication approach and strategies adapted to these specific aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe clear goals and objectives • Describe criteria of effectiveness • Access primary literature and handouts • Revue the steps to be followed to prepare a technical report
<p>Element 3: Plan and organize the content of the communications</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Validation of the accuracy of the content with the qualified authorities • Strategic selection of communication means and media • Content and format of materials organized in order to communicate appropriate educational and strategic information 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use computers to generate figures and tables • Contrast data sets to estimate accuracy of sampling
<p>Element 4: Produce all the elements required for the communications</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Quality of the different communication elements produced: texts, images, tables, presentations • Appropriate popularization of the content of the communications • Use of terminology and language adapted to the target audience • General quality of the language and organization of the different communication elements • Consideration of applicable presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Work as part of a team to prepare maps and figures • Work individually to prepare data tables • Determine the proper terminology and referencing format for technical report writing
<p>Element 5: Present the content of the communications</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct application of rules and principles 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p>

<p>pertaining to oral and written communication as well as communication intended for the media</p> <ul style="list-style-type: none"> • Appropriate use of the different media • Consideration of different communication styles in their dealings with the target audience • General quality of the communications: coherence, clarity, accurate language 	<ul style="list-style-type: none"> • List the format elements for report preparation • Apply scientific terms and organize information in a clear logical sequence • Make direct references to their data in the scientific literature to support their evaluations • Summarize the conclusions
<p>Competency 044K: To plan the technical and logistical aspects of an applied research project.</p>	
<p>Element 1: Analyze the determining parameters of a project.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous analysis of the problem and questions on which the research is based • Clear explanation of the project's objectives and issues • List of all of the project's important determinants, including those related to ethics 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Discuss, as part of a group, the goals and objectives prior to sampling • Review the potential techniques available for data gathering • Examine the limitations imposed by the equipment used, available time and manpower, and study site characteristics
<p>Element 2: Describe the tasks and operations involved in carrying out the project.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete list of relevant tasks and operations • Presentation of the different tasks in a logical sequence • Applicability of the sequence proposed • Optimal management of time allotted 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • List the steps and sampling schedules required to achieve goals and objectives • Have alternate plans to allocate manpower or equipment as needed to maintain the sampling schedule
<p>Element 3: Determine the resources required.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the types and quantities of resources required • Appropriate use of different catalogues • Establishment of an exhaustive list of resources pertaining to lodging, transportation, food, equipment and safety • Establishment of an exhaustive list of materials involved in applying the protocol (technical aspects) 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Compile equipment lists for field sampling and to respect health and safety norms • Participate in a small team; individual teams will verify that their equipment is clean and operational prior to field use
<p>Element 4: Establish how to acquire and transport resources to the work site.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete inventory of resources already in stock • Selection of appropriate suppliers • Determination of acquisition method (lease or buy) according to the available budget • Determination of delivery method according to prescribed deadlines and the sequence of work tasks • Proper preparation of purchase orders • Appropriate planning of purchase and delivery follow-up 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Inventory resources and stock in order to complete the project • Prepare lists of missing equipment for purchase • Discuss, as part of a group, the transport required for equipment and personnel • Arrange a transport schedule which meets the field sampling objectives • Prepare lab equipment for analysis of field samples
<p>Element 5: Take the legislative framework into account and adjust their planning accordingly.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of all procedures related to laws and regulations in effect • Acquisition of required permits and authorizations • Planning in conformity with laws and regulations 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Confirm that local property owners rights have been respected • Confirm that permission to use the land has been obtained

in effect	<ul style="list-style-type: none"> Confirm that required scientific permits have been obtained
Competency 044L: To work in a team.	
Element 1: Exercise positive leadership within a team.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Competent exercise of the role of team leader when the circumstances require it Balanced, equitable sharing of tasks and responsibilities among team members Effective management of potentially conflictual situations Proper leadership provided for tasks to be performed Openness to constructive criticism Significant contribution to creating an atmosphere of collaboration and consensus Formulation of relevant recommendations aimed at improving the effectiveness of the team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Work in small teams to complete field sampling and lab analysis Participate in evening class meetings to discuss progress and problems To work by consensus to resolve problems Consult from remote locations with faculty when problems arise
Element 2: Participate actively in the team effort, taking on their share of responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Proper preparation of work meetings and their personal participation Active contribution to achieving the objectives set by the team Organized presentation of their views on different topics on the agenda Clear, logical arguments proposed in support of their opinions Adequate emotional control with respect to interpersonal conflict and diverging opinions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Consult with team members to ensure that data collection is complete Interact with other team members to assemble and pre-check equipment prior to field/lab work Discuss problems or differences in a professional manner
Element 3: Adapt to the people they are working with.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Continued effort to understand the occupational realities of the people they work with and the terminology they use Accurate understanding of the dynamics among the various persons concerned: <ul style="list-style-type: none"> determinants related to the specific cultural practices and aspects of the persons concerned ongoing and completed project activities on the agenda issues and interests defended by each party quality and history of relationships between the various persons concerned Adaptation of their language, approach and attitudes to the characteristics of the persons they are working with Demonstration of a real ability to create a climate conducive to harmonious, productive work within a heterogeneous team 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Participate in meetings, as needed, with the entire class Propose topics for discussion relating to day to day operations Identify differences within the group which may be building towards a conflict Achieve a group consensus as to how to resolve potential problems
Competency 044P: To apply wilderness survival techniques.	
Element 1: Apply the necessary preventive measures in a natural environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Recognition of the sources of potential danger 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p>

<p>according to the types of tasks and the conditions for performing them</p> <ul style="list-style-type: none"> • Establishment of an emergency plan • Preparation of all necessary materials • Communication of adopted measures to the persons concerned 	<ul style="list-style-type: none"> • Prepare and carry a field survival pack • Post their location on a central map prior to field work • Estimate the time of return from field work • Plan an emergency escape route if lost
Element 2: Find their bearings in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of landmarks in order to determine their position • Determination of cardinal points based on clues in the environment • Determination of the direction required for their return 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Use GPS in the field • Enter GPS data onto GIS software for site locations • Interpret topographical maps • Perform basic orienteering with compasses
Element 3: Find food in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of edible species • Application of techniques for capturing animal species • Lighting of fire • Location of a source of drinking water 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify plants in the field • Access information on local edible plant species and plant parts by seasonal availability • Carry emergency food supplies, matches, snare wires, fish line and hooks and a basic medical kit and a survival pack • Apply tincture of iodine to purify water
Element 4: Find shelter in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate construction of a temporary shelter • Adequate protection against wind, cold and rain 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Access information on constructing emergency shelters • Use ground sheets and space blankets • Use knives, snare wire and fish line to construct shelters
Element 5: Adopt appropriate attitudes and behaviours in an emergency situation.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Demonstration of self-control and level headedness • Ability to work independently and to be resourceful • Effective management of factors that could compromise their survival: <ul style="list-style-type: none"> – pain – cold – thirst – hunger – fatigue – boredom and isolation – hazards of all kinds 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Plan for an emergency situation • Assemble sufficient emergency supplies to overnight in the field • Access medical gear to treat or transport injured personnel • Use CPR and field first aid
Element 6: Manage the factors that could contribute to the survival of a group.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper, methodical organization of group members • Optimal use of each member's skills • Realistic study of the situation and demonstration of decision making appropriate to the circumstances • Quick reflexes and ability to apply survival 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Get certified in field first aid and CPR prior to field work • Able to apply emergency procedures and distress signals

skills	
Competency 044R: To describe the biotic components of a terrestrial environment.	
Element 1: Plan the work under their responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the tasks • Determination of all required organizational and material means as well as the conditions for implementing them • Location on maps of sampling points • Determination of the route to be taken in compliance with environmental constraints • Respect for budget constraints • Respect for time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • List the steps to be followed for field sampling • Estimate the time required for each task • Prepare standardized sheets for data recording • Prepare field maps for individual teams • Respect the limitations imposed by the study site characteristics, sampling techniques chosen, time, budget, and available manpower • Follow the norms for safe field operations
Competency 044T: To conduct an ecosystemic analysis of a territory.	
Element 1: Participate in planning the work according to the initial problem.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the different aspects and components to be analyzed • Strategic distribution of work among team members • Development of a common methodology and analysis grid 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Determine the biotic and abiotic components to be sampled • Establish the sampling sequence to meet the goals and objectives • Work within a team to efficiently maximize available manpower • Prepare standardized field/lab sheets for data recording and analysis
Element 2: Acknowledge the data components relative to the natural environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous analysis of data on the biotic or abiotic resources specific to the components studied • Extraction of data relevant to the initial problem • Justification of data retained and summary processing of the data • Summary reconciling the common points and differences among various studies • Formulation of an overall impression of the component(s) analyzed 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Tabulate and synthesize raw data • Extract data to analyse specific aspects of the problem • Determine if sample size is adequate to meet the goals and objectives of the survey • Contrast similarities and dissimilarities in different sets of data
Element 3: Establish the interactions among the different components.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Clear, accurate and brief reporting • Highlighting of the predominant interactions among components in terms of the initial problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Relate differences in sample results to variations in local site conditions • use clear concise language in a technical report
Element 4: Participate in producing a summary portrait of the environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formulation of a diagnostic impression to determine the predominant factors accounting for the dynamics of the environment • Determination of factors that may be influenced 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Work as part of a group to present figures showing differences in the local habitat • Prepare an individual technical report analysing interactions among environmental components
Element 5: Participate in formulating recommendations for solving the initial problem.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>

<ul style="list-style-type: none"> ▪ Relevance and feasibility of the recommendations formulated 	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Summarize the main environmental determinants of a local ecosystem • Recommend improvements to techniques or training to increase the efficiency of field sampling
<p>Competency 044U: To apply scientific approach to problem-solving in a natural environment.</p>	
<p>Element 1: Define the problem</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate interpretation of the clues observed • Relevant, clear questions formulated • Accurate description of the nature and scope of the problem • Clear, accurate statement of the problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Carry out a field reconnaissance of an area to be studied • Discuss within a group the goals and objectives of the study • Define with precision the parameters to be measured
<p>Element 2: Formulate a hypothesis regarding the causes of the problem</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant hypothesis put forth • Theoretical validation of the hypothesis put forth in terms of the current knowledge on the subject • Determination of the type of approach to take • <i>A priori</i> determination of the expected results and the degrees of confirmation of the hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Review the types of information gathered by intensive and extensive sampling methods • Examine the advantages/disadvantages of alternative techniques available to meet the goals and objectives
<p>Element 3: Plan the research process</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous determination of how the work should proceed: <ul style="list-style-type: none"> • nature of parameters and data • methodological elements and corresponding steps • procedures for inputting and processing data • Determination of the required resources • Effective organization of how and where the work should take place • Consideration of all health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • As part of a group, discuss and choose the best techniques with respect to the limitations of the terrain, equipment, time, budget, and available manpower • Follow all norms for safe field operations
<p>Element 4: Apply the chosen methodology</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of protocol • Adequate use of the techniques associated with different operations • Complete, accurate data collected • Appropriate processing of data 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Work as part of a field sampling team • Follow the sampling sequence for biotic/abiotic measurements • Complete field data sheets • Synthesize data through computer tabulation
<p>Element 5: Analyze the results obtained in order to confirm or reject the hypothesis</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Detailed review of the application of the process in order to confirm that the data obtained is reliable • Identification of the main sources of errors and bias that could interfere with the quality of results and their interpretation • Systematic comparison of actual and expected results • Relevant conclusions regarding the initial 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Consult with primary literature for the strengths and weaknesses of individual sampling techniques • Contrast data sets to determine if sampling was adequate • Identify sources of error and make recommendations to help avoid these • Summarize the conclusions

hypothesis	
Element 6: Write a technical report	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Complete report in conformity with the standards in effect for scientific presentation: <ul style="list-style-type: none"> – description of the initial problem – description of the methodology – data and results obtained – analysis of results and ensuing conclusions • Formulation of relevant recommendations: <ul style="list-style-type: none"> – generalization of the solution if the hypothesis is confirmed – formulation of a new hypothesis if the hypothesis is rejected 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • prepare a technical report in conformity with the scientific format (brief and accurate project title; introduction with clear goals and objectives; acknowledgements; study site description; results; discussion of data relevant to the hypotheses; conclusions; references and appendices)

Course Title	Ecological Cartography	
Course Code	145-651-VA	
Competencies	0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it. 044A: To use digital and computer technologies on the job. 044E: To convey information about a natural environment. 044N: To apply health and safety measures. 044P: To apply wilderness survival techniques.	
Ponderation	1-2-2	
Credits	1 2/3	
Prerequisites	Wilderness 1 st Aid	
Links: Backward	420-706-VA Computer Skills, 145-531-VA Limnology, 145-541-VA Fisheries Management, 145-561-VA Ecotoxicology	
Forward	NA	
Current Semester	145-611-VA Mammal Management, 145-641-VA Research Project (Group)	
Course Description		
<p>This course focuses on measuring, portraying, and interpreting our spatial world through maps and imagery. This course, along with the course in Environmental GIS, provides the student with the skills to visually assess and query our terrestrial and aquatic environment. Facility will be gained with tools ranging from map-and-compass to remotely sensed imagery to GPS-enabled depth sounders. The relevance and impact of location with respect to safety is also examined. General field safety and survival is also covered.</p>		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
<ul style="list-style-type: none"> • While conducting watershed analyses in an ecological time scale • While conducting analyses including field work (when certain data provided must be validated) and the interpretation of thematic maps and aerial photographs • Based on all the soil, sediment and water samples provided, meteorological data and a minimal description of the organisms found • Using appropriate documentation: classification keys pertaining to soil, sediment and surface deposit studies; data sheets; thematic maps (all types of maps used in the field) and aerial photographs • Using appropriate tools: instruments required for analyzing aerial photographs and maps • For all work-related tasks • Using applications related to word and image processing, data processing and the creation of databases • Using applications related to geomatics, cartography and the presentation of data and scientific information • For purposes of interpretation and training, scientific popularization and the production of scientific materials, including technical reports and parts of research reports • Based on specific requests and expressed or perceived information needs • Given sufficient access to different sources of scientific data, models representing various forms of communication, the required computer 		<p>In the classroom</p> <ul style="list-style-type: none"> Lectures Discussion Textbook Class notes <p>In the field</p> <ul style="list-style-type: none"> - Acquisition of the ability to dependably orient oneself using both basic (map & topo map) and higher tech (GPS, GIS, RS) tools and to collect useful, map-able information - Proficiency in mapping lakes using depth sounder technology. <p>In the lab</p> <ul style="list-style-type: none"> - Practical usage and interpretation of topographic maps. Understanding of cartographic standards as they apply to hardcopy and GIS maps. Interpretation and usage of bathymetric data. Interpretation and usage of remotely sensed imagery. Basics of nearshore navigation. <p>As with Env GIS, a fundamental goal is for students to achieve spatial literacy.</p>

<ul style="list-style-type: none"> equipment and any other appropriate apparatus For all types of activities performed in a natural environment and in a lab Using the required documentation Using the required materials: first-aid kit, protective clothing and equipment, and health and safety facilities In an emergency situation and in extreme conditions Working alone or in a team Using basic survival materials and a basic first-aid kit 	
<p>Competency 0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.</p>	
<p>Element 1: Describe the relief of a watershed or ocean basin.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Accurate interpretation of different thematic maps and aerial photographs Delineation of the watershed and description of its geomorphologic aspects (more in Outlook-on-the-Environment?) Determination of the main erosive factors explaining the formation of the relief (more in Outlook-on-the-Environment?) 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Practically recognize and employ/apply the information inherent in the themes of hardcopy/digital maps. Through the examination of aerial photos, extract relevant ecological and habitat characteristics.
<p>Competency 044A: To use digital and computer technologies on the job.</p>	
<p>Element 4: Use geomatics tools and georeferenced maps.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Given existing maps and corresponding files, proper use of the functions for extracting data in order to represent certain aspects of a problem Addition of data to existing maps in order to modify or update them, or to add supplemental information Accurate interpretation of georeferenced maps 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Use the functions and tools within GIS software to utilize and/or modify attribute tables so as to generate suitable themes in associated maps.
<p>Element 5: Use a variety of digital equipment for image processing.</p>	
<p><u>Performance Criteria:</u></p> <ul style="list-style-type: none"> Adequate use of a digital camera, camcorder and scanner Transfer of data from a GPS system to a computerized system Inputting and basic processing of a variety of images Importing and integration of digital images in different types of files 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Use digital cameras in the field to document relevant habitat features and activities, and also to hotlink such images to a GIS map. Transfer field-collected GPS coordinate data (e.g. waypoints) from a GPS unit to an attribute table within a GIS.
<p>Competency 044E: To convey scientific information</p>	
<p>Element 1: Describe the different target audiences</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Thorough analysis of the target audience's needs and characteristics Accurate establishment of the target audience profile 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Differentiate whether cartographic products will be intended for consumption by a scientific vs a more lay audience and create them accordingly
<p>Element 4: Produce all the elements required for the communications</p>	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Quality of the different communication elements produced: texts, images, tables, presentations • Appropriate popularization of the content of the communications • Use of terminology and language adapted to the target audience • General quality of the language and organization of the different communication elements • Consideration of applicable presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Include the appropriate degree of detail and utilize the appropriate language/jargon and format of graphics (e.g. figures, labels, legends).
<p>Competency 044N: To apply health and safety measures.</p>	
<p>Element 1 : Recognize the potential risks in a lab and in the field</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate distinction of the different types of risks: <ul style="list-style-type: none"> • environmental factors • factors related to the types of tasks, including handling and containing a variety of organisms • factors related to the use of products, apparatus and equipment • factors related to attitudes and general behaviours • Careful observation and accurate interpretation of signs of potential danger • Realistic assessment of the degree of danger involved in various risky situations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Conduct him/herself safely in both lab and field environments. Risks factors of both will be thoroughly reviewed. <ul style="list-style-type: none"> - Lab aspects will cover chemicals and products, methodology, safety resources and response. - Field aspects will cover risk perception, preparedness, proper use of orientation tools, survival. Will build on the Wilderness 1st Aid course.
<p>Element 2 : Apply the necessary health and safety preventive measures.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate understanding of the site evacuation plan • Accurate location of equipment and identification of resource persons in the event of an emergency • Verification that all health and safety materials are accessible and in good working order • Development of materials according to the weaknesses observed • Adoption of safe behaviours and attitudes in all circumstances • Rigorous application of preventive measures with respect to: <ul style="list-style-type: none"> • handling organisms • using hazardous products • using equipment 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <p>[Interior]</p> <ul style="list-style-type: none"> • Respond appropriately in evacuating the work and residence facilities. • Know what follow-up precautions to take to insure the safety of others. • Locate and use necessary emergency equipment. <p>[Exterior]</p> <ul style="list-style-type: none"> • Conduct field activities (use of gear, handling specimens) in a safe and recommended manner.
<p>Element 3 : Take action in an emergency or in the event of an accident on the work site</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Full knowledge of their obligations and responsibilities • Application of emergency measures with level headedness and according to established procedures • Proper administration of first aid in the field and in the lab • Effective organization of procedures for evacuating injured persons • Prompt communication with the appropriate authorities 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • On the basis of previously acquired training in 1st Aid & CPR, respond to emergency situations, to the degree that their training has prepared them. • Recognize when further more advanced treatment is required and take steps to access it.
<p>Competency 044P: To apply wilderness survival techniques. See comments for 044N above.</p>	
<p>Element 1: Apply the necessary preventive measures in a natural environment</p>	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Recognition of the sources of potential danger according to the types of tasks and the conditions for performing them • Establishment of an emergency plan • Preparation of all necessary materials • Communication of adopted measures to the persons concerned 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Act prudently and be prepared to offer aid and assistance, both in terms of immediate response and also w.r.t. extricating someone from a dangerous circumstance. • Have necessary response materials at the ready (interior or exterior situations).
<p>Element 2: Find their bearings in an emergency situation.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of landmarks in order to determine their position • Determination of cardinal points based on clues in the environment • Determination of the direction required for their return 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Orient and extricate themselves and others on the basis of field cartographic skills (map, compass, GPS, etc.). • Generally maintain an awareness of location, prior to emergency situations.
<p>Element 5: Adopt appropriate attitudes and behaviours in an emergency situation.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Demonstration of self-control and level headedness • Ability to work independently and to be resourceful • Effective management of factors that could compromise their survival: <ul style="list-style-type: none"> • pain • cold • thirst • hunger • fatigue • boredom and isolation • hazards of all kinds 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Through an understanding of potential dangers, be both mentally and physically equipped to respond to emergencies, based on their knowledge and skill in 1st Aid response and also on their familiarity with the characteristics of environments (in the bush, on the water) and the kinds of potential dangers each entails.
<p>Element 6: Manage the factors that could contribute to the survival of a group.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper, methodical organization of group members • Optimal use of each member's skills • Realistic study of the situation and demonstration of decision making appropriate to the circumstances • Quick reflexes and ability to apply survival skills 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Respond as both a member of a team and as a leader, recognizing and employing both strengths/weaknesses within the group versus the dangers they face.

Course Title	Environmental G.I.S.	
Course Code	145-661-VA	
Competencies	0449: To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it. 044A: To use digital and computer technologies on the job. 043W: To establish the profile of a situation using statistics. 044T: To conduct an ecosystemic analysis of a territory. 044U: To apply the scientific approach to problem-solving. 044V: To carry out experiments related to a natural environment.	
Ponderation	2-2-4	
Credits	2 2/3	
Prerequisites		
Links: Backward	145-111-VA Outlook on the Environment, 420-706-VA Computer Skills, 145-421-VA Laboratory Techniques and Instrumentation, 145-531-VA Limnology, 145-541-VA Fisheries Management, 145-561-VA Ecotoxicology	
Forward	NA	
Current Semester	145-611-VA Mammal Management, 145-641-VA Research Project (Group)	
Course Description		
<p>Geographic Information Systems (GIS) are proving to be an extremely effective tool in understanding, managing, and conserving the environment. This course uses both theoretical concepts and hands-on experience in order to provide students with the knowledge and skills necessary for effective use of GIS (and other geomatic tools). In particular, this course is used to support relative spatial aspects of other courses in the Environmental and Wildlife Management Program so that the student will learn how to utilize geotechnology in practical ways. The primary GIS tool used in this course is ESRI ArcView.</p>		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
<ul style="list-style-type: none"> • While conducting watershed analyses in an ecological time scale • While conducting analyses including field work (when certain data provided must be validated) and the interpretation of thematic maps and aerial photographs • Based on all the soil, sediment and water samples provided, meteorological data and a minimal description of the organisms found • Using appropriate documentation: classification keys pertaining to soil, sediment and surface deposit studies; data sheets; thematic maps (all types of maps used in the field) and aerial photographs • Using appropriate tools: instruments required for analyzing aerial photographs and maps • For all work-related tasks • Using applications related to word and image processing, data processing and the creation of databases • Using applications related to geomatics, cartography and the presentation of data and scientific information • For activities carried out in a natural environment: research, land-use planning, resource management, etc. • Under the supervision of the project coordinator • Based on raw or preprocessed data pertaining to the main aspects of the situation under study, a previously formulated working hypothesis and a general description of the situation • Using the required tools, including appropriate software and any necessary documentation 		<ul style="list-style-type: none"> • In the classroom <ul style="list-style-type: none"> - Lectures - Discussion - Textbook - Class notes • In the field <ul style="list-style-type: none"> - Spatial data collection accompanying sampling, collections, & observations related to fieldwork conducted in various courses throughout the program. Use of GPS units, topographic map layers, and imagery. • In the lab <ul style="list-style-type: none"> - Using computer-based GIS and related geomatic technology to lend spatial assessment and interpretation to the content of other EWM courses. - Use of existing and created data and map layers. <p>Fundamental goal is for students to achieve spatial literacy.</p>

Competency 0449 : To analyze the dynamics of the physical components of a natural environment and the organisms that inhabit it.	
Element 1: Describe the relief of a watershed.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate interpretation of different thematic maps and aerial photographs • Delineation of the watershed or ocean basin and description of its geomorphologic aspects • Determination of the main erosive factors explaining the formation of the relief 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Interpret and apply existing thematic map layers to situations at hand at scales ranging from the local to the watershed. • Create/ modify such layers and their attributes as necessary.
Competency 044A: To use digital and computer technologies on the job.	
Element 3: Use computerized tools for statistical processing and data representation	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Design of relevant computerized worksheets useful for collecting and inputting data • Determination of a worksheet and file format adapted to the study parameters and their specific context • Validation of whether the worksheets are functional • Correct inputting of data provided • Use of basic functions related to the application's statistical processing • Use of basic functions related to the creation of pivot tables and the production of graphs • Correct transfer of data to a database • Formulation of queries in order to use the database 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Employ dedicated GIS software packages to both plan and thereafter analyze field activities. • Create or modify attribute tables suitable for containing and thereafter analyzing data. • Use available statistical and tools and functions to summarize and clarify the data.
Element 4: Use geomatics tools and georeferenced maps.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Given existing maps and corresponding files, proper use of the functions for extracting data in order to represent certain aspects of a problem • Addition of data to existing maps in order to modify or update them, or to add supplemental information • Accurate interpretation of georeferenced maps 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Assess existing data within attribute tables (aided by appropriate metadata), add to/ modify them as necessary to support his/her purposes. • Interpret georeferenced maps, especially as they relate to the local area (may be both urban and rural applications).
Element 5: Use a variety of digital equipment for image processing.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate use of a digital camera, camcorder and scanner • Transfer of data from a GPS system to a computerized system • Inputting and basic processing of a variety of images • Importing and integration of digital images in different types of files 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • In a manner serving to lend spatial context and comprehension to a subject, coordinate the use of digital photography (via hotlinking), as well as download GPS coordinate data to a GIS and incorporate them into a project file. • Incorporate images from purchased sources on on-line sites, as appropriate.
Competency 043W: To establish the profile of a situation using statistics.	
Element 1: Input data using a computer	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formulation of appropriate queries according to the database • Proper use of appropriate applications, including formatting a spreadsheet 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Effectively explore data sets through standard GIS querying techniques and language.

<ul style="list-style-type: none"> • Complete, accurate data input 	
Element 2: Validate the data provided	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Identification of bias related to data collection • Accurate assessment of the degree of accuracy and relevance of the measurements provided • Rejection of invalid and irrelevant data 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Select appropriate classification techniques that are both relevant and realistic for the data sets at hand and for the questions asked. • Recognize where conclusions generated are based on faulty GIS technique.
Element 3: Determine the type of statistical processing required	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct characterization of samples: types of samples, types of parameters and types of distributions • Selection of statistical operations and tests according to the type of data and the initial hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Select from the limited statistical tools of a GIS and use them within their limits, but recognize that more extensive statistical assessment will require techniques and tools used in other EWM courses.
Element 4: Perform the statistical processing required	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of appropriate statistical functions • Selection of relevant variables • Proper execution of selected functions and accurate calculations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Conduct limited statistical assessments of spatial and attribute data, within the limits described previously.
Element 5: Format and present the data in graph form	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of the most appropriate form of graphic presentation • Quality of the tables: <ul style="list-style-type: none"> • relevance of data presented • consideration of appropriate parameters (format, organization and legibility to facilitate interpretation) • Quality of the figures: <ul style="list-style-type: none"> – presentation of highlights – conformity with presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Apply the standard graphical tools contained in a GIS to elucidate trends and comparisons contained within spatial/attribute data. • Present such graphical information according to standards commonly found in relevant and primary literature for environmental sciences.
Competency 044T: To conduct an ecosystemic analysis of a territory.	
Element 1: Participate in planning the work according to the initial problem.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the different aspects and components to be analyzed • Strategic distribution of work among team members • Development of a common methodology and analysis grid 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Consider the primary elements and objectives field project and decide how it might benefit by including a spatial aspect.
Element 2: Acknowledge the data components relative to the natural environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous analysis of data on the biotic or abiotic resources specific to the components studied • Extraction of data relevant to the initial problem • Justification of data retained and summary processing of the data • Summary reconciling the common points and differences among various studies • Formulation of an overall impression of the component(s) analyzed 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Offer how spatial review of a project could assist in interpreting various field-collected data.

Element 3: Establish the interactions among the different components.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Clear, accurate and brief reporting • Highlighting of the predominant interactions among components in terms of the initial problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Bring spatial insight to bear on clarifying interactions (such between things that might be close enough to one another to influence one another).
Element 4: Participate in producing a summary portrait of the environment.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formulation of a diagnostic impression to determine the predominant factors accounting for the dynamics of the environment • Determination of factors that may be influenced 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Complement the understanding of environmental dynamics by suggesting spatial relationships.
Element 5: Participate in formulating recommendations for solving the initial problem.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevance and feasibility of the recommendations formulated 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Assist in the management and recommendation process by offering spatial support.
Competency 044U: To apply scientific approach to problem-solving in a natural environment.	
Element 1: Define the problem	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Accurate interpretation of the clues observed • Relevant, clear questions formulated • Accurate description of the nature and scope of the problem • Clear, accurate statement of the problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Decide if a spatial aspect of the problem exists that could be profitably examined through GIS.
Element 2: Formulate a hypothesis regarding the causes of the problem	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Relevant hypothesis put forth • Theoretical validation of the hypothesis put forth in terms of the current knowledge on the subject • Determination of the type of approach to take • <i>A priori</i> determination of the expected results and the degrees of confirmation of the hypothesis 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Contribute to hypothesis generation in those instances where the examined parameters exist in a spatial context.
Element 3: Plan the research process	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous determination of how the work should proceed: <ul style="list-style-type: none"> • nature of parameters and data • methodological elements and corresponding steps • procedures for inputting and processing data • Determination of the required resources • Effective organization of how and where the work should take place • Consideration of all health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Inform the design of the investigation such that spatially useful information and knowledge is most likely to be gained (e.g. sample site placement).
Element 4: Apply the chosen methodology	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Rigorous application of protocol • Adequate use of the techniques associated with 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Advise on how methodology might be best

<p>different operations</p> <ul style="list-style-type: none"> • Complete, accurate data collected • Appropriate processing of data 	<p>constructed so that it will lend itself to being spatially analysed.</p>
<p>Element 5: Analyze the results obtained in order to confirm or reject the hypothesis</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Detailed review of the application of the process in order to confirm that the data obtained is reliable • Identification of the main sources of errors and bias that could interfere with the quality of results and their interpretation • Systematic comparison of actual and expected results • Relevant conclusions regarding the initial hypothesis 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Compare results achieved relative to originally proposed questions and ascertain support of original spatial questions, and make adjustments as necessary.
<p>Competency 044V: To carry out experiments related to a natural environment-</p>	
<p>Element 1: Participate in determining objectives, procedures and a timetable.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect for budget constraints • Respect for time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects • Formulation of a relevant opinion on the technical feasibility of the project 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Frame the experimental field work to be done in a spatial context. • Advise the experimental designers on how best to structure the field work so that it will be as spatially meaningful as possible.
<p>Element 5: Write a technical report.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Sequential description of all the operations performed • Complete list of the materials and products used as well as the organisms studied 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Rigorously report on the spatial activities that were engaged in and catalogue the technology, products, and resources that were used.

Course Title	Biometry
Course Code	201-234-VA
Competencies	043W: To establish the profile of a situation using statistics.
Ponderation	1-2-2
Credits	1 2/3
Prerequisites	
Links: Backward	420-706-VA Computer Skills
Forward	101-311-VA Ecology
Current Semester	None
Course Description	
<p>This is an elementary statistics course with emphasis placed on ecological and biological applications. The student will be introduced to the basics of descriptive and inferential statistics. Topics covered include experimental design organizing data, measures of central tendency and variation, Binomial, Poisson and Normal distributions, testing hypotheses, linear regression and analysis of variance.</p> <p>The usage of techniques and tools learned in this course will allow the students to collect, analyze and present ecological data in a rigorous quantitative manner.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> Based on raw or pre-processed data pertaining to the main aspects of a situation under study, a previously formulated working hypothesis and a general description of the situation Using required tools, including appropriate software and any necessary documentation 	<ul style="list-style-type: none"> In the classroom or in a computer lab. Using a spreadsheet with statistical functions or specialized statistical software. Using data provided by the instructor or collected by students/faculty in the Program. Based on the appropriate statistical concepts, introduced in the course, following similar examples of collection, analysis and presentation of ecological and biological data and with the assistance of the instructor.
Competency 043W: To establish the profile of a situation using statistics.	
Element 1: Design an experiment and validate data provided.	
<u>Performance Criteria</u> <ul style="list-style-type: none"> Identification of bias related to data collection Reasonable assessment of the degree of accuracy and relevance of measurements provided Rejection of invalid and/or irrelevant data 	<u>Learning Outcomes</u> Students will be able to: <ul style="list-style-type: none"> Identify possible sample bias; Classify random, stratified systematic and cluster sampling Generate simple random samples; Identify extreme variability and reject irrelevant values in samples; Estimate the impact of errors of measurements Critically evaluate an experimental design
Element 2: Input data using a computer.	
<u>Performance Criteria</u> <ul style="list-style-type: none"> Formulation of appropriate queries according to the database Proper use of appropriate applications, including formatting a spreadsheet Complete, accurate data input 	<u>Learning Outcomes</u> Students will be able to: <ul style="list-style-type: none"> Choose appropriate statistical tools to use; Enter data correctly; Present data in a comprehensible format that conveys the sense of the situation described by the data.
Element 3: Determine the type of data	

<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct characterization of sample data and types of distributions <ul style="list-style-type: none"> – Selection of statistical operations and tests according to the type of data. 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Classify the type of data, <i>i.e.</i>, qualitative quantitative, discrete and continuous; • Identify continuous or discrete distributions applicable to a sample • Compute probabilities using binomial, Poisson and normal distributions; • Select and use statistical tools and statistical functions appropriate to the type of data at hand.
<p>Element 4: Perform required statistical processing.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of appropriate statistical functions • Selection of relevant variables <ul style="list-style-type: none"> – Proper execution of selected functions and accurate calculations 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Select and use appropriate software statistical functions to compute relevant values; • Compute measures of central tendency, dispersion, and spread of the particular distribution.
<p>Element 5: Format and present data in graphical form.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Selection of the most appropriate form of graphical presentation • Quality of tables: <ul style="list-style-type: none"> – relevance of data presented – consideration of appropriate parameters (format, organization and legibility to facilitate interpretation) • Quality of figures: <ul style="list-style-type: none"> – presentation of highlights – conformity with presentation standards 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Select appropriate graph types from amongst those available in Excel or Minitab; • Organize tables of values that are well-labeled and easy to read and understand; • Synthesize key results in summaries, with respect to known standards.
<p>Element 6: Analyze data and interpret results obtained</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Correct definitions of different statistical concepts used, with appropriate terminology • Accurate explanations regarding statistical processing performed • Interpretation of the results in context of the initial problem 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Employ appropriate notation and terminology in all work; • Correctly select and apply statistical analysis performed: <ul style="list-style-type: none"> – formulate the null hypothesis and research hypothesis – construct confidence intervals – run a statistical test after verifying that conditions for those tests are met; – briefly discuss the conclusions of the hypotheses tests taking into account all the necessary assumptions – synthesize all steps of the statistical analysis in the final report

Course Title	General Chemistry	
Course Code	202-111-VA	
Competencies	044B: To describe the abiotic components of a natural environment. 004C: To carry out laboratory analyses. 004N: To apply health and safety measures.	
Ponderation	2-2-2	
Credits	2	
Prerequisites		
Links: Backward	NA	
<i>Forward</i>	Forward: 202-311-VA Solution Chemistry, 145-421-VA Laboratory Techniques and Instrumentation, 145-561-VA Ecotoxicology	
<i>Current Semester</i>	None	
Course Description This course provides a review of the application of scientific method to study various biological and environmental processes. The theory presented in lectures and the laboratory experiments carried out provide the student with a solid background in the understanding of the Periodic Table, nomenclature of inorganic and organic compounds, chemical bonding and the role of organic functional groups in biological and environmental processes. The course also emphasizes the importance of health and safety as well as ethics in conducting scientific experiments		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
<ul style="list-style-type: none"> Analyzing samples taken in the field or in the lab Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects Using the required materials: first-aid kit, protective clothing and equipment, and health and safety facilities 		<ul style="list-style-type: none"> In the classroom <ul style="list-style-type: none"> Lectures Class notes Textbook In the lab <ul style="list-style-type: none"> Physical and chemical techniques used in analyzing samples
Competency 044B : To describe the abiotic components of a natural environment.		
Element 3 : Analyze the samples.		
<u>Performance Criteria</u> <ul style="list-style-type: none"> Analysis of all the physical and physicochemical parameters required Rigorous use of analysis instruments in compliance with prescribed techniques Good tactile and visual sensitivity 		<u>Learning Outcomes</u> Students will be able to: <ul style="list-style-type: none"> Identify and analyze the required parameters for a given sample Choose and utilize appropriate analytical instrument for a given task Develop good laboratory practices
Element 4 : Take the necessary measurements.		
<u>Performance Criteria</u> <ul style="list-style-type: none"> Measurement of all physical and physicochemical parameters required Rigorous use of measuring instruments in compliance with prescribed techniques 		<u>Learning Outcomes</u> Students will be able to: <ul style="list-style-type: none"> Carry out appropriate techniques relevant to the measurement of various physical and physicochemical parameters

<ul style="list-style-type: none"> Optimal accuracy and quality of measurements according to established protocols 	<ul style="list-style-type: none"> Properly use equipment necessary for such measurements Follow established protocols in order to maintain the precision and accuracy required in such measurements
Element 5 : Compile all the data.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Complete, correct inputting of data on worksheets Regular, methodical verification to ensure that data is valid and complete 	<p><u>Learning Outcomes</u></p> <p>The student will be able to</p> <ul style="list-style-type: none"> insert the experimental data on worksheets using appropriate tabular and/or graphical representations test data completeness and validity
Element 6 : Keep a technical log.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Complete list of the materials and products used Sequential description of all the operations performed Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> methodology work context and conditions 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Describe objective(s) of the experiment List equipment and chemicals used Follow methodology Perform calculations Present the data and the final result.
Competency 044C : To carry out laboratory analyses.	
Element 1 : Plan the work under their responsibility.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Determination of the sequence of all the steps involved in performing the work Determination of all required organizational and material means as well as the conditions for implementing them Respect budget constraints Respect time constraints related to the types of protocols and established deadline Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> List all the steps to be followed Estimate time for each task List all the physical and chemical agents to be used and verified if safer and less expensive alternatives can be used Follow the health and safety aspects of physical and chemical agents to be used and their health and safety aspects verified using the appropriate MSDS (Material Safety Data Sheet).
Element 2 : Perform the preliminary work required for the analyses.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> Proper assembly, adaptation and calibration of equipment Accurate calculations for the dilution and concentration of solutions Accurate conversions of concentration units Methodical preparation of solutions, using volumetric instruments and the required materials Preparation and preprocessing of samples according to the types of analysis required 	<p><u>Learning Outcomes</u></p> <p>Student will be able to:</p> <ul style="list-style-type: none"> Assemble and calibrate equipment needed to perform an analysis Calculate solution concentrations and preparing dilute solutions using stock solutions Relate various concentration units such as molarity, ppm, % etc. Extract ingredients from samples Process samples.
Competency 044N : To apply health and safety measures.	
Element 1 : Recognize the potential risks in a lab and in the field.	
<u>Performance Criteria</u>	<u>Learning Outcomes</u>

<ul style="list-style-type: none"> • Accurate distinction of the different types of risks: <ul style="list-style-type: none"> • factors related to the types of tasks, including handling and containing a variety of organisms • factors related to the use of products, apparatus and equipment • factors related to attitudes and general behaviours • Careful observation and accurate interpretation of signs of potential danger • Realistic assessment of the degree of danger involved in various risky situations 	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Identify sources of chemical, biological and physical hazards • Apply preventive measures used in a laboratory environment. • Implement WHMIS (Workplace Hazardous Material Information System) • Interpret MSDS (Material Safety Data Sheet)
<p>Element 2 : Apply the necessary health and safety preventive measures.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Adequate understanding of the site evacuation plan • Accurate location of equipment and identification of resource persons in the event of an emergency • Adoption of safe behaviours and attitudes in all circumstances • Rigorous application of preventive measures with respect to: <ul style="list-style-type: none"> • using hazardous products • using equipment 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Locate the safety equipment and materials • Follow college wide emergency plans in case of fire or other accidents • Observe rules of laboratory conduct • Consult appropriate MSDS (Material Safety Data Sheet) before handling hazardous materials

Course Title	Solution Chemistry	
Course Code	202-311-VA	
Competencies	044B : To describe the abiotic components of a natural environment. 044C : To carry out laboratory analyses. .	
Ponderation	3-2-2	
Credits	2	
Prerequisites		
Links: Backward	145-111-VA Outlook on the Environment, 202-111-VA General Chemistry	
<i>Forward</i>	145-421-VA Laboratory Techniques and Instrumentation, 145-431-VA Bioremediation and Waste Management, 145-561-VA Ecotoxicology, 145-531-VA Limnology	
<i>Current Semester</i>	None	
Course Description This course provides a review of the application of scientific method to study various biological and environmental processes. The theory presented in lectures and the laboratory experiments carried out provide the student with a solid background in the understanding of the solubility, concentration units and stoichiometry, chemical equilibrium, acids and bases, oxidation and reduction, diffusion, osmosis and chemical kinetics.		
ACHIEVEMENT CONTEXT		LEARNING CONTEXT
Analyzing samples taken in the field or in the lab <ul style="list-style-type: none"> Using the required documentation, apparatus, instruments and tools as well as all the means related to logistical aspects 		<ul style="list-style-type: none"> In the classroom <ul style="list-style-type: none"> Lectures Class notes Textbook In the lab <ul style="list-style-type: none"> Physical and chemical techniques used in analyzing samples
Competency 044B : To describe the abiotic components of a natural environment		
Element 4: Take the necessary measurements.		
Performance Criteria <ul style="list-style-type: none"> Measurement of all physical and physicochemical parameters required Rigorous use of measuring instruments in compliance with prescribed techniques Optimal accuracy and quality of measurements according to established protocols 		Learning Outcomes Students will be able to: <ul style="list-style-type: none"> Carry out technique(s) relevant to the measurement of various physical and physicochemical parameters Properly use equipment necessary for such measurements Follow established protocols in order to maintain the precision and accuracy required in such measurements
Element 5: Compile all the data.		
Performance Criteria <ul style="list-style-type: none"> Complete, correct inputting of data on worksheets Regular, methodical verification to ensure that 		Learning Outcomes Students will be able to: <ul style="list-style-type: none"> Correctly present the experimental data on worksheets using appropriate tabular and/or

<p>data is valid and complete</p>	<p>graphical representations</p> <ul style="list-style-type: none"> • Test its completeness and validity
<p>Element 6: Keep a technical log.</p>	
<p><u>Performance Criteria</u> Complete list of the materials and products used</p> <ul style="list-style-type: none"> • Sequential description of all the operations performed • Rigorous recording of all relevant complementary information: <ul style="list-style-type: none"> • methodology • work context and conditions 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Describe objective(s) of the experiment • List equipment and chemicals used • Follow methodology • Perform calculations • Present the data and the final result.
<p>Competency 044C: To carry out laboratory analyses.</p>	
<p>Element 1: Plan the work under their responsibility.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Determination of the sequence of all the steps involved in performing the work • Determination of all required organizational and material means as well as the conditions for implementing them • Respect budget constraints • Respect time constraints related to the types of protocols and established deadline • Consideration of all important health and safety aspects 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • List all the steps to be followed • Estimate time for each task • List all the physical and chemical agents to be used and verified if safer and less expensive alternatives can be used • Follow the health and safety aspects of physical and chemical agents to be used and their health and safety aspects verified using the appropriate MSDS (Material Safety Data Sheet).
<p>Element 2: Perform the preliminary work required for the analyses.</p>	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Proper assembly, adaptation and calibration of equipment • Accurate calculations for the dilution and concentration of solutions • Accurate conversions of concentration units • Methodical preparation of solutions, using volumetric instruments and the required materials • Preparation and preprocessing of samples according to the types of analysis required 	<p><u>Learning Outcomes</u> Students will be able to:</p> <ul style="list-style-type: none"> • Assemble and calibrate equipment needed to perform an analysis • Calculate solution concentrations and preparing dilute solutions using stock solutions • Relate various concentration units such as molarity, ppm, % etc. • Extract ingredients from samples • Process samples.

Course Title	Computer Skills
Course Code	420-706-VA
Competencies	044A: To use digital and computer technologies on the job. 043W: To establish the profile of a situation using statistics.
Ponderation	1-2-2
Credits	1 2/3
Prerequisites	
Links: Backward	NA
Forward	201-234-VA Biometry, 101-311-VA Ecology, 145-651-VA Ecological Cartography, 145-661-VA Environmental G.I.S.
Current Semester	None
<p>Course Description</p> <p>In this course, students will acquire the computer skills for gathering accurate input data to create a database, perform data analysis and interpretation; and finally, present this data for establishing the profile of environmental and ecological resources by integrating recent computer technologies. Students will create their own Web site to store this data and will also access data stored in other Web sites. Appropriate techniques and computer software will be taught to enable students to write a complete scientific document by including information from different data sources such as other scientific documents, databases, worksheets, XML data files, and so forth.</p>	
ACHIEVEMENT CONTEXT	LEARNING CONTEXT
<ul style="list-style-type: none"> • For all work-related tasks • Using applications related to word and image processing, data processing and the creation of databases • Using applications related to geomatics, cartography and the presentation of data and scientific information • For activities carried out in a natural environment: research, land-use planning, resource management, etc. • Under the supervision of the project co-ordinator • Based on raw or pre-processed data pertaining to the main aspects of the situation under study, a previously formulated working hypothesis and a general description of the situation • Using the required tools, including appropriate software and any necessary documentation 	<ul style="list-style-type: none"> • Using tutorials in the classroom • Working in teams to learn-by-doing in the computer lab • By visiting specific Web sites and by creating a Web site for storing and sharing relevant information • Searching the Internet for existing documents and related events • Following the guidelines and help provided by the instructor • Using XML and databases for storing and getting access to relevant data • Using appropriate computer software and adequate lecture handouts
Competency 044A: To use digital and computer technologies on the job.	
Element 1 : Manage their computer environment	
<p>Performance Criteria</p> <ul style="list-style-type: none"> • Correct installation of computer and peripherals • Correct installation of applications • Customising of desktop and applications used • Efficient organisation of files 	<p>Learning Outcomes</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Accomplish computer file and folder operations such as create, rename, delete, make a copy, move, compress and decompress a file/folder. • Organise hierarchically computer files and folders • Use computer memory storage devices such as USB flash memory and CD. Format, backup up and check for computer memory space. • Customise the computer desktop. • Download and install computer applications. Create and use shortcuts.

Element 2: Use word-processing applications.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formatting of scientific documents • Creation of templates and style sheets • Importing and integration of various elements 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Carry out word processing operations • Create scientific documents and professional reports. • Work with templates and style sheets • Create a complete document by integrating recent technologies and by importing data analysis and assessment results from other applications
Element 6: Use the Internet and Intranet for purposes of research and communication.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Effective access to networks • Secure use of functions for sharing files and folders • Efficient use of Web browsers • Compilation of electronic vertical files (directory of sites) relevant to the field 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Work with Web sites: create a simple Web site, login to upload/download files, deal with Web site membership and directories of environmental and ecological Web sites. • Understand the terminology and Internet concepts for research activities and communication. Use different searching strategies. • Use Extensible Mark-up Language (XML) for data transfer and sharing • Transfer data between different applications using information technology such as word processors, electronic spreadsheets, database management systems and Internet Web sites.
Competency 043W: To establish the profile of a situation using statistics.	
Element 1: Input data using computers.	
<p><u>Performance Criteria</u></p> <ul style="list-style-type: none"> • Formulation of appropriate queries according to the database • Proper use of appropriate applications, including formatting a spreadsheet • Complete, accurate data input 	<p><u>Learning Outcomes</u></p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Design a simple database for data storage and retrieval. Create and query environmental and ecological databases • Establish environmental and ecological profiles by using electronic worksheets. • Work with electronic spreadsheets for making arithmetic calculation, statistical data analysis and graphs for presenting bioecological data. • Use XML data files for accurate input and retrieval of bioecological data.