HIGHER UNIVERSITY TECHNICIAN IN AQUACULTURE
PROJECTS SPECIALIST
COURSE SYLLABUS WITH BREAKDOWN OF THEMATIC UNITS

1. Course	**ECOLOGY**
2. Competencies	Conduct the production of auxiliary organism cultured, based on the evaluation of the conditions of the Aquaculture systems, to contribute to the profitability of the organization.
3. Four Month Period	3
4. Practical Hours	55
5. Theoretical Hours	65
6. Total Hours	120
7. Week Total Hours Four Month Period	8
8. Course Objective	The student will determine the biotic and abiotic components of the ecosystems, through the study of populations and communities, to contribute to the sustainability of the aquaculture projects.

Theme Units	Hours		
	Practical	Theoretical	Total
I. Fundamentals of Biological Sciences.	0	10	10
II. Population	25	10	35
III. Interactions	10	10	20
IV. Community	15	20	35
V. Ecosystems	5	15	20
Total	**33**	**27**	**60**

ECOLOGY

THEMATIC UNITS I

1. Theme Unit	**I. Fundamentals of Biological Sciences.**
2. Practical Hours	0
3. Theoretical Hours	10
4. Total Hours	10
5. Objective	The student will identify the relationship between biotic and abiotic factors to develop aquaculture projects.

Themes	Learning to know	Learning to do	Learning to be
Environment	To describe the concepts of: - Environment and its factors: biotic and abiotic. - Humidity and temperature. - Soil and solar radiation. - The marine currents and their importance.		Analytical and synthesis ability Organized Systematic
Basic concepts of ecophysiology	To explain the fundamental concepts of ecophysiology: - Homeostasis - Limiting factors. - Tolerance limits (curves performance) - Photosynthesis - Respiration		Observer Analytical and synthesis ability Organized Systematic

ECOLOGY

Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
The student will elaborate an essay including: - A description of the importance of the interaction between biotic and abiotic factors. - A conceptual map of the basic concepts of: Environment and Ecophysiology.	1. To understand the basic concepts of environment and ecophysiology. 2. To analyze the interaction between biotic and abiotic factors.	Essay Checklist.

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Teaching Learning Process	
Method and teaching techniques	**Media and didactic materials**
Research Tasks Collaborative teams Directed reading	Whiteboard Markers Projector Computer Internet

Learning Space		
Classroom	**Laboratory / Workshop**	**Company**
X		

ECOLOGY

THEMATIC UNITS II

1. Theme Unit	**II. Populations**
2. Practical Hours	25
3. Theoretical Hours	10
4. Total Hours	35
5. Objective	The learner will calculate the demographic parameters and the aquaculture population growth, to contribute to the development of projects of organisms in cultivation.

Themes	Learning to know	Learning to do	Learning to be
Conceptual basis pf opulations	To identify the concept of biological population. To explain the role of populations in trophic structures. To explain the flow of energy and matter among populations.		Analytical and synthesis ability Organized Systematic
Study methods of populations.	To explain the characteristics and elements of the study methods of populations: -Demography. -Life tables and curves of survival. -Age structure.	To estimate the fertility, mortality and survival rates of an aquaculture population. To build life tables and their survival curves.	Observer Analytical and synthesis ability Organized Systematic

Themes	Learning to know	Learning to do	Learning to be
Models of population growth.	- To explain the characteristics and calculations of the population growth models of: - Discrete generations: exponential and logistic. - Continuous generations: exponential and logistic. - Age structure or size: Dies of Leslie y Lefkovitch	To estimate the population growth in aquaculture communities.	Analytical and synthesis ability Organized Systematic
Strategies and population regulation.	To explain the concepts, characteristics and models of adaptive strategies: R and K; C, S and R. To identify the concept and characteristics of commitments: energy budgets and vital processes.	To determine the type of adaptive strategy present in a population.	Observer Analytical and synthesis ability Organized Systematic

ECOLOGY

Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
From a case, the student will elaborate a study report in an aquaculture population that contains: - Description of an aquaculture population of study. - Calculation of fertility, mortality and survival rates. - Survival curve. - Life table and age structure. - Population growth model. - Type of current adaptive strategy.	1. To understand the fundamental concepts of population. 2. To identify the characteristics and elements of the methods of populations studies. 3. To understand the models of population growth and its importance. 4. To calculate the population growth. 5. To identify the types of adaptive strategies of the populations.	Cases Study. Checklist.

ECOLOGY

Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Research Tasks Collaborative Teams Directed Reading	Whiteboard Markers Projector Computer Internet

Learning Space		
Classroom	**Laboratory / Workshop**	**Company**
X		

ECOLOGY

THEMATIC UNITS III

1. Theme Unit	**III. Biological Interactions**
2. Practical Hours	10
3. Theoretical Hours	10
4. Total Hours	20
5. Objective	The student will distinguish the interactions between living beings, in order to promote the development of the cultivation of aquaculture organisms.

Themes	Learning to know	Learning to do	Learning to be
Introduction to interactions.	To explain the concepts, characteristics and types of biological interactions. To identify the fundamental niche theory.		Analytical and synthesis ability Organized Systematic
Competition.	To explain the characteristics, types and models of competition: interspecific and intra-specific.	To estimate intra-and/or interspecific competition of species in aquaculture ecosystems.	Observer Analytical and synthesis ability Organized Systematic
Depredation.	To explain the characteristics, types and models of depredation.	To estimate predator-prey interactions in aquaculture ecosystems.	Analytical and synthesis ability Organized Systematic
Mutualism	To explain the characteristics, types and models of mutualism. To explain the concepts, characteristics of mutualism and co-evolution.	To determine mutualism among species in aquaculture ecosystems.	Observer Analytical and synthesis ability Organized Systematic

Themes	Learning to know	Learning to do	Learning to be
Parasitism	To explain the characteristics, types and models of parasitism.	To estimate the prevalence and degree of parasitism in aquaculture ecosystems.	Observer Analytical and synthesis ability Organized Systematic

ECOLOGY

Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
From cases, the student will elaborate a report including: - Description of intraspecific and interspecific interactions identified. - Selection of the model according to the type of interaction detected in the aquaculture ecosystem studied. - Memory of the calculations of the models used. - Analysis and conclusions.	1. To understand the concept, characteristics and types of biological interactions. 2. To analyze the interaction of intra-specific and interspecific competence and the existing theoretical models. 3. To analyze the interaction of depredation and the existing theoretical models. 4. To analyze the interaction of mutualism and coevolution and the existing theoretical models.	Cases Study. Checklist.

ECOLOGY

Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Problems Solution Collaborative Teams Cases Analysis	Whiteboard Markers Projector Computer Internet

Learning Space		
Classroom	**Laboratory / Workshop**	**Company**
X		

ECOLOGY

THEMATIC UNITS IV

1. Theme Unit	**IV. Communities**
2. Practical Hours	15
3. Theoretical Hours	20
4. Total Hours	35
5. Objective	The student will characterize biotic communities, to determine the flows of energy and matter in aquaculture systems.

Themes	Learning to know	Learning to do	Learning to be
Basic concepts and attributions.	To identify the concept of biotic community. To explain trophic structures within biotic communities. To explain the flow of energy and matter in the biotic community.		Observer Analytical and synthesis ability Organized Systematic
The Communities	To explain the types and characteristics of the communities: - As an organism. - From an individualistic point of view. To explain the biodiversity indexes: Simpson and Shannon.	To calculate the biodiversity indexes of an aquaculture community.	Observer Analytical and synthesis ability Organized Systematic

Themes	Learning to know	Learning to do	Learning to be
Interactions organism-abiotic environment.	To explain the concept, characteristics and quantification of primary productivity in biotic communities. To explain the types of models of trophic structure: - Energy flow in the form of “Y”. - Of chlorophyll based in the area.	To determine the level of primary productivity. To distinguish the trophic structures and the model that explains them.	Observer Analytical and synthesis ability Organized Systematic

ECOLOGY

Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
- From a practice, the student will elaborate a report including: - Description of the elements of the aquaculture community. - Calculation of the biodiversity indexes, by means of different methods. - Primary productivity grade. - Trophic structures and energy flow. - Conclusions.	1. To understand the basic concepts, characteristics and types of biological communities and their importance. 2. To understand trophic structures and the flow of energy in communities. 3. To identify the biodiversity indexes. 4. To understand the concept, characteristics and quantification of primary productivity. 5. To understand the models of trophic structure.	Practical exercises. Checklist.

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Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Problems Solution Collaborative Teams Cases Analysis	Whiteboard Projector Computer Internet Laboratory equipment

Learning Space		
Classroom	**Laboratory / Workshop**	**Company**
	X	

ECOLOGY

THEMATIC UNITS V

1. Theme Unit	**V. Freshwater, Coastal and Marine Ecosystems.**
2. Practical Hours	5
3. Theoretical Hours	15
4. Total Hours	20
5. Objective	The student will distinguish the characteristics of the types of aquatic ecosystems, for the selection of aquaculture crops.

Themes	Learning to know	Learning to do	Learning to be
Freshwater Ecosystems	To identify the characteristics and components of a freshwater ecosystem.	Characterize a freshwater ecosystem.	Observer Analytical and synthesis ability Organized Systematic
Coastal Ecosystems	To identify the characteristics and components of a coastal ecosystem.	Characterize a coastal ecosystem.	Observer Analytical and synthesis ability Organized Systematic
Marine Ecosystems	To identify the characteristics and components of a marine ecosystem.	Characterize a marine ecosystem.	Observer Analytical and synthesis ability Organized Systematic

ECOLOGY

Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
The pupil will elaborate a conceptual map of the three types of ecosystems, including: - Biotic Factors. - Abiotic Factors. - Interactions identified. - Energy flows and trophic structure	1. To identify the characteristics of a freshwater ecosystem as well as the biotic and abiotic factors. 2. To identify the characteristics of a coastal ecosystem as well as the biotic and abiotic factors. 3. To identify the characteristics of a marine ecosystem as well as the biotic and abiotic factors.	Essays. Checklist.

ECOLOGY

Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Research Work. Collaborative Teams Directed Reading	Whiteboard Markers Project Computer Internet

Learning Space		
Classroom	**Laboratory / Workshop**	**Company**
X		

ECOLOGY

CAPACITIES DERIVED FROM THE PROFESSIONAL COMPETENCES TO WHICH THE COURSE CONTRIBUTES

Capacity	Performance Criteria
To schedule aquaculture system conditioning activities, the product demand and climatic conditions, to optimize resources and meet production goals.	To elaborate a program of the productive cycle based on the manual of good practices that includes: - water quality monitoring - water refills - disinfection activities of the infrastructure and the system - acquisition of supplies
To program the activities of the productive cycle according to the biology of the species, the demand of the product and the climatic conditions, to optimize the resources and to fulfill the production goals.	To elaborate a program of the productive cycle based on the manual of good practices for the respective species or species and that includes: - planting period (climatic and biology of the species) - morphometric measurements of the organisms - homogenization of sizes of the organisms - harvest period - feeding schedules - water quality monitoring - water refills - disinfection activities of the infrastructure and the system
To supervise the reproduction process in aquaculture systems by means of the methodology corresponding to each species, considering the good management practices, for obtaining larvae and post-larvae and offspring.	To write a reproduction log according to the manual of good practices and reproduced species where it reports the following data: - selection of reproductive species - number of reproductive species (males and females) - reproductive density in systems, degree of gonadal maturation - physicochemical parameters of reproduction systems - data for statistical control (date, time, number of the pond, number of eggs, biometrics, percentage of survival).
To direct the sowing process through the methodology corresponding to each species and considering the good management practices, to start the production cycle and avoid economic losses.	To prepare a report on the transportation, arrival and sowing process based on the good practices manual, that includes: - Transportation: conditions of reception of organisms, number of organisms, size, weight, temperature, oxygen, legal documentation, preventive treatments, method and time of transport. - Arrival at the farm: tempering methodology, number of organisms, weight, sizes, planting densities, preventive treatments - Planting method.

Capacity	Performance Criteria
To verify the fattening process of the aquaculture organisms through biometric, health, innocuousness and nutrition techniques, based on the good practices to contribute to the performance and quality of aquaculture production.	To write a log of the fattening process of aquaculture organisms, based on the good practices, that includes: - Morphometric records. - Records of physicochemical parameters of water quality. - Observations of the signs of internal or external injuries, diseases and behavior alterations. - Record of feeding (percentages of protein, food ration, feed conversion and pellet size). - Mortality records - Preventive, and corrective treatments and adjustments.
To supervise the process of harvesting aquaculture products based on the established program, the methods and techniques corresponding to the species and the good practices, to meet the requirements of the organization and the market.	To prepare a report on the harvesting process of aquaculture products, based on the good practices, specifying: - Harvesting techniques according to the species and stage of development - Indicators of compliance with the goals or objectives of the organization - Analysis and interpretation of indicators - Conclusions and recommendations
To diagnose the environment, social, economic, physical environmental and normative according to the criteria of regional diagnostic study, to identify the possibility of developing aquaculture projects.	To prepare a technical report on the regional context of the aquaculture sector, describing the following aspects: - Social character of the population: composition, mortality rate, fertility, growth, education, migration, economically active population. - Economic nature: productive sectors, GDP, economic activities, - Physical-environmental character: geographical, biological, climatological characterization. - Normative character: applicable regulations - Opinion on the possibility for developing aquaculture projects.
Calculate the production capacity of a sustainable aquaculture project through a technical study, to establish the species and the required aquaculture production system.	To prepare a report that reflects the productive potential of the sustainable aquaculture project, which should include: - Location and specific description of the project site - Infrastructure and equipment - The species to work with - The processes and technologies to be used. - The capacity of processes and production programs. - Scenarios with different processes of volumes. - Programs of execution, administrative, training and technical assistance. - Applicable regulatory framework. - Project production and investment costs. - Production costs and investment of the project. Opinion on the technical feasibility of the Project.

Capacity	Performance Criteria
To evaluate the environmental impact of the sustainable aquaculture project through a study with reference to the applicable regulations, to establish the remediation and mitigation measures and obtain the respective approval.	To prepare an Environmental Impact Statement for an aquaculture project that includes: - General information about the project, the promoter and the person responsible for the environmental impact study - Project description. - Linkage with the applicable legal systems in environmental matters, where applicable, with the regulation on land use. - Description of the environmental system and identification of the environmental problems detected in the area of influence of the project - Identification, description and evaluation of environmental impacts. - Preventive measures and mitigation of environmental impacts. - Environmental forecasts and, where appropriate, evaluation of alternatives. - Identification of the methodological instruments and technical elements that support the indicated information.

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