HIGHER UNIVERSITY TECHNICIAN IN AQUACULTURE
PROJECTS SPECIALIST

COURSE SYLLABUS WITH BREAKDOWN OF THEMATIC UNITS

1. Course	**Biostatistics**
2. Competencies	Direct the production of auxiliary organism cultured, based on the conditions evaluation of the aquaculture systems to contribute to the profitability of the organization.
3. Four Month Period	Second
4. Practical Hours	60
5. Theoretical Hours	30
6. Total Hours	90
7. Week Total Hours Four Month Period	6
8. Course Objective	The student will determine the behavior of variables in aquaculture populations, using statistical tools for decision making.

Theme Units	Hours		
	Practical	Theoretical	Total
I. Introduction	8	4	12
II. Probability Theory	9	6	15
III. Probabilistic Models	7	4	11
IV. Confidence Intervals	8	4	12
V. Hypothesis Testing	14	6	20
VI. Linear Regression and Correlation	14	6	20
Total	**60**	**30**	**90**

BIOSTATISTICS

THEMATIC UNITS

1. Theme Unit	**I. Introduction**
2. Practical Hours	8
3. Theoretical Hours	4
4. Total Hours	12
5. Objective	The student will calculate the measures of central tendency and dispersion to describe the behavior of a statistical population.

Themes	Learning to know	Learning to do	Learning to be
Definitions and types of statistics	To explain the fundamental concepts of statistics and their classification.		Efficient Observer Methodical Analytical
Descriptive statistics: frequency charts and graphs.	To explain the concepts of frequency tables, their characteristics and application	To build frequency tables and their graphs from a dataset.	Efficient Observer Methodical Analytical
Concept of simple, population and universe.	To describe the concepts of simple, population and universe.		Efficient Observer Methodical Analytical
Central tendency measures.	To explain the methodology for calculating the measures of central tendency and their interpretation: arithmetic mean, pruned average, geometric mean, harmonic mean, fashion, median, quartiles, deciles,	To calculate the measures of central tendency to graph the results of the calculation of the measures of central tendency. To interpret the results.	Efficient Observer Methodical Analytical

Themes	Learning to know	Learning to do	Learning to be
Scatter measures.	To explain the methodology for calculating the dispersion measures: range, interquartile range, mean deviation, variance, standard deviation and coefficient of variation.	To calculate the dispersion measures. To graph the results of the calculation of the dispersion measures. To interpret the results.	Efficient Observer Methodical Analytical

BIOSTATISTICS

Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of Reagents**
The learner will solve a number of cases in the aquaculture area, that includes: - Calculations of the central tendency measures. - Calculation of the dispersion measures. - Graphs - Results interpretation.	1. To identify the basic concepts of statistics. 2. To understand the procedure for calculating central tendency and dispersion measures. 3. To understand the procedure of plotting of the measures of central tendency and dispersion. 4. To interpret the results.	Study Cases. Checklist.

BIOSTATISTICS

Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Research Practical Exercises Cases study	Computers with Word processor and spreadsheet software installed. Projector Screen Board Markers Calculator

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

BIOSTATISTICS

THEMATIC UNITS

1. Theme Unit	**II. Probability Theory**
2. Practical Hours	9
3. Theoretical Hours	6
4. Total Hours	15
5. Objective	The student will understand the key concepts of probability and their methodologies for calculating significant sample sizes.

Themes	Learning to know	Learning to do	Learning to be
Counting techniques: permutations and combinations	To describe the concepts of conditional probability event, independent event and dependent event, permutations and combinations. To explain the methods of calculating the possible combination and permutations of occurrence of events.	To calculate permutations and occurrence combinations of possible aquaculture-related events.	Efficient Observer Methodical Analytical
Exhibition space and events.	To recognize the basic operations of sets: union, intersection, complement and difference. To describe the concepts and scope of the sample space and events.	To calculate the basic operations of sets. To determine a sample area. To represent sets graphically.	Efficient Observer Methodical Analytical
Sum of probabilities	To explain the probability sum theorem by using the Venn-Euler diagrams.	To calculate the sum of probabilities.	Efficient Observer Methodical Analytical

Themes	Learning to know	Learning to do	Learning to be
Conditional Probability	To explain the product theorem in probability by using the Venn-Euler diagrams.	To calculate the probabilities product.	Efficient Observer Methodical Analytical
Bayes Theorem	To define Bayes theorem, its application and importance in the probabilities.	To calculate the probability of occurrence of events between separate sets.	Efficient Observer Methodical Analytical

BIOSTATISTICS

Evaluation process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
From a real case related to aquaculture, the learner will develop a report that includes: - Description of the sample space. - Venn-Euler Diagrams. - Events description. - Probability calculation.	1. To understand the basic concepts of probability. 2. To understand the methods of calculation, permutations and combinations. 3. To recognize basic sets operations. 4. To understand the procedure of calculating the sum and probabilities product. 5. To understand the procedure for calculating the occurrence probability of events between independent sets.	Cases study. Checklist.

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Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Research Exercise Resolution. Cases Study.	Computers with Word processor and spreadsheet software installed. Projector Screen Board Markers

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

BIOSTATISTICS

THEMATIC UNITS

1. Theme Unit	**III. Probabilistic Models**
2. Practical Hours	7
3. Theoretical Hours	4
4. Total Hours	11
5. Objective	The student will explain the behavior of a set of data, using probabilistic models, to solve problems related to aquaculture.

Themes	Learning to know	Learning to do	Learning to be
Binomial	To explain the binominal distribution model and its characteristics.	To solve aquaculture problems related to the binominal distribution model.	Efficient Observer Methodical Analytical
Hypergeometric	To explain the hypergeometric distribution model and its characteristics.	To solve aquaculture problems related to the hypergeometric model.	Efficient Observer Methodical Analytical
Poisson	To explain the Poisson distribution model and its characteristics.	To solve problems related to the Poisson distribution model.	Efficient Observer Methodical Analytical
Normal and central boundary theorem	To explain the normal distribution model and the central boundary theorem and its characteristics.	To solve aquaculture problems related to normal distribution model.	Efficient Observer Methodical Analytical

Themes	Learning to know	Learning to do	Learning to be
Log-Normal	To explain the Lognormal distribution model and its characteristics.	To solve aquaculture problems related to the Lognormal distribution model.	Efficient Observer Methodical Analytical
Chi-Squared	To explain the Chi-squared model and its characteristics.	To solve aquaculture problems related to the binominal distribution model.	Efficient Observer Methodical Analytical
Student's-T	To explain the Student's T model and its characteristics.	To solve aquaculture problems related to the Student's T distribution model.	Efficient Observer Methodical Analytical
Fisher-F	To explain Fisher's F distribution model.	To solve aquaculture problems related to Fisher's distribution model.	Efficient Observer Methodical Analytical

BIOSTATISTICS

Evaluation process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
From a number of aquaculture-related cases, the learner will prepare a report that contains: - Justification. - Development of probabilistic models. - Analysis of the results. - Conclusions	1. To identify probabilistic models and their characteristics. 2. To understand the procedure for calculating probabilistic models. 3. To interpret the results.	Cases Study Checklist.

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Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Practical Exercises Case Analysis Research Tasks	Computers with spreadsheet software installed. Projector Screen Board Markers

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

BIOSTATISTICS

THEMATIC UNITS

1. Theme Unit	**IV. Confidence Intervals**
2. Practical Hours	8
3. Theoretical Hours	4
4. Total Hours	12
5. Objective	The student will calculate the confidence intervals to define the limits of the values in the measures of central tendency or of dispersion.

Themes	Learning to know	Learning to do	Learning to be
Confidence intervals concept.	To define the concept of confidence intervals, their application and importance.		Efficient Observer Methodical Analytical
Calculating confidence intervals.	To explain the procedure of calculating confidence intervals in the central tendency and dispersion measures.	To solve calculation problems of confidence intervals in the mean and variance.	Efficient Observer Methodical Analytical

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Evaluation process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
From a real case in the aquaculture area, the pupil will calculate the confidence intervals and submit a report that includes: - Calculation Memory - Interpretation	1. To understand concept of confidence intervals and their application. 2. To understand confidence intervals calculation procedure. 3. To interpret the calculation results of the confidence intervals.	Practical Exercise. Checklist.

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Teaching Learning Process	
Methods and teaching techniques	**Media and didactic materials**
Research Tasks Practical Exercises Case Analysis.	Computers with spreadsheet software installed. Projector Screen Board Markers

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

BIOSTATISTICS

THEMATIC UNITS

1. Theme Unit	**V. Hypothesis Testing**
2. Practical Hours	14
3. Theoretical Hours	6
4. Total Hours	20
5. Objective	The student will predict the behavior of a set of data under determined conditions, to establish actions.

Themes	Learning to know	Learning to do	Learning to be
Hypothesis Testing	To define the concepts of hypothesis tests, types of errors, level of significance and their characteristics.		Efficient Observer Methodical Analytical
Parametric hypothesis testing.	To explain the methodology of calculating parametric hypothesis tests: types of error and level of significance.	To solve problems by calculating parametric hypothesis tests.	Efficient Observer Methodical Analytical

BIOSTATISTICS

Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
From a case of aquaculture area, the student will integrate a report that contains: - Approach of the problem. - Calculation of hypothesis testing. - Interpretation.	1. To understand the concepts of hypothesis testing, error types and significance level. 2. To understand procedure for calculating hypothesis tests. 3. To interpret the results of the calculation of hypothesis tests.	Cases Study. Checklist.

BIOSTATISTICS

Teaching Learning Process	
Teaching Methods and Techniques	**Media and Teaching Materials**
Research Tasks Practical Exercises Case Analysis.	Computers with spreadsheet software installed. Projector Screen Board Markers

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

WRITTEN BY: COMMITTEE OF DIRECTORS OF TSU CAREER IN AQUACULTURE PROJECTS SPECIALIST.

APPROVED BY: C. G. U. T.

REVISED BY: ACADEMIC AND LIAISON COMMISION OF THE AREA

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THEMATIC UNITS

1. Theme Unit	**VI. Linear Regression and Correlation**
2. Practical Hours	14
3. Theoretical Hours	6
4. Total Hours	20
5. Objective	The student will determine the interaction between two variables to propose actions.

Themes	Learning to know	Learning to do	Learning to be
Simple linear regression	To explain the simple linear regression model with the hypothesis testing methods, confidence intervals, variance analysis. To explain the methodology of the calculation of simple linear regression by the method of least squares.	To solve simple linear regression problems by applying the minimum square adjustment method.	Efficient Observer Methodical Analytical
Correlation	To describe the concepts of simple linear correlation coefficient, comparison of correlation coefficients, correlation and their relation by ranges. To relate the correlation with the hypothesis test explaining the methodology of calculating the correlation coefficient.	To solve problems of aquaculture by means of the statistical tests of simple linear correlation coefficient.	Efficient Observer Methodical Analytical

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Evaluation Process		
Learning outcomes	**Learning sequence**	**Instruments and type of reagents**
From a case of the aquaculture area, the student will submit a report that includes: - Linear regression analysis and adjustment by the method of least squares. - Correlation coefficient. - Interpretation	To understand the concept of simple linear regression and its relation with the methods of testing hypothesis, intervals of confidence, analysis of variance. To understand the linear regression methodology and its adjustment by the method of least squares. To understand the methodology of calculating the correlation coefficient and its application.	Cases Study. Checklist.

BIOSTATISTICS

Teaching Learning Process	
Methods and teaching techniques	**Media and Didactic materials**
Research Task Practical Exercises Case Analysis.	Computers with spreadsheet software installed. Projector Screen Board Markers

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

BIOSTATISTICS

CAPACITIES DERIVED FROM THE PROFESSIONAL COMPETENCES TO WHICH THE COURSE CONTRIBUTES

Capacity	Performance Criteria
To diagnose the conditions of aquaculture systems. Through physicochemical and biological analysis techniques and historical records, to guarantee the health, safety and profitability of production.	Prepare a report on the conditions under which an aquaculture system is found, containing: - Obtaining and processing the samples and their justification. - Analysis and interpretation of information (logs, histories, analysis results, laboratory reports). Conclusions and recommendations.
To verify the fattening process of aquaculture organisms through biometric, health, safety and food techniques, based on good practices to contribute to the performance and quality of aquaculture production.	The student prepares logbooks of the fattening process of aquaculture organisms, based on good practices, which should include: - 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, corrective treatments and adjustments.
Supervise the technical conditions of the sustainable aquaculture project according to the technical criteria and the applicable regulations, to comply with the requirements of the implementation.	Prepare a report on the process of harvesting aquaculture products, based on 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

Capacity	Performance Criteria
State the potential market of an aquaculture product through an analysis of the situation of the markets, to identify marketing opportunities.	Prepare a report about the market analysis of aquaculture products that includes: - Characteristic of the markets of the main products and supplies. - Channels of distribution and sale. - Conditions and mechanisms for supplying raw materials and supplies. - Plan and marketing strategy: A) Price structure of products and by-products, as well as sales policies. B) Competitiveness analysis. C) Income projection Letters of Intent and/or contracts for the purchase and sale of raw materials and products.

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Author	Year	Title	City	Country	Publisher
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Blaesid, P. et al.	(2003)	*Statistics with application to Biology and Geology*		USA	Chapman and Hall
Hines, William W.	(2005)	*Probabilidad y Estadística para Ingeniería*	Mexico, D. F.	México	CECSA
Zar, J. H.	(2006)	*Bioestatistical Analysis*	Upper Sadle River	USA	Prentice Hall
Wayne, W. Daniel	(2008)	*Bioestadística.*	México, D. F.	México	Limusa
Blair, Cliford	(2008)	*Bioestadística*	Mexico, D. F.	México	Person Prentice Hall