

**PRE-REQUISITE** F.Sc. or equivalent**LEARNING OUTCOMES**

- This course will provide an introduction to the basic concepts of statistics and its application in hydrology.
- The students will learn to perform various statistical analyses (consistency and homogeneity test, estimating the measures of central tendency, dispersion and symmetry etc.).
- The students will learn the concepts of probability and Probability Distributions The students will get used to the concepts of hypothesis testing.
- Students will learn about the correlations and regression analysis.
- The students will learn about time series analysis

**CONTENTS**

This course provides an introduction to the statistical theories, and probability theories and their applications in environmental sciences. This course will also provide an understanding of time series analysis, correlation and regression analyses as well as hypothesis testing.

**Unit-1: Introduction and Basic Concepts of Descriptive statistics**

- 1.1. Introduction of statistics
- 1.2. Data types, sampling and tabulation
- 1.3. Measure of central tendency of data (Mean Median, Mode quartile, range etc)
- 1.4. Measure of data Dispersion (Standard Deviation, variance, Skewness and Kurtosis)
- 1.5. Graphical presentation of data

**Unit-2: Basic probability concepts and Probability distributions**

- 1.1. Basic concepts of Probability
- 1.2. Rules of Probability
- 1.3. Event and space of event
- 1.4. Random variables
- 1.5. Discrete probability distribution
- 1.6. Continues probability distribution

**Unit-3: Parameter estimation**

- 1.1. Sampling distribution
- 1.2. Sampling errors
- 1.3. Confidence interval
- 1.4. Choice of estimator
- 1.5. Accuracy and bias of estimator

**Unit-4: Correlation and Regression**

- 1.1. Correlation Analysis, Serial or Auto-Correlation, Cross-Correlation, Inferences on Correlation Coefficient, Kendall's Rank Correlation Test
- 1.2. Simple Linear Regression, Estimation of Parameters, Goodness of Regression
- 1.3. Multiple Linear Regression, Estimation of Parameters, Goodness of Regression
- 1.4. Analysis of variance ANOVA
- 1.5. Model fit validation using diagnostic analysis

**Unit-5: Hypothesis Testing**

- 1.1. The t-distribution
- 1.2. Chi-Square Distribution
- 1.3. Tests Concerning Variances of Two Populations

## Unit-6: Introduction to time series

- 1.1. Components of time series
- 1.2. Filtering and smoothing
- 1.3. Serial correlation
- 1.4. ARIMA Models
- 1.5. Advance modeling

## TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

## ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

## ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

## RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Al-Karkhi, A. F., & Alqaraghuli, W. A. (2019). *Applied statistics for environmental science with R*. Elsevier.
2. David, V. (2019). *Statistics in Environmental Sciences*. John Wiley & Sons.
3. Maity, R. (2018). Basic Concepts of Probability and Statistics. In *Statistical Methods in Hydrology and Hydroclimatology* (pp. 7-51). Springer, Singapore.
4. Rodda, H. J., & Little, M. A. (2015). *Understanding mathematical and statistical techniques in hydrology: an examples-based approach*. John Wiley & Sons.
5. Manly, B. F. (2008). *Statistics for environmental science and management*. Chapman and Hall/CRC.

## **ENSC-310: DATA ANALYSIS (PRACTICAL) (01 Credit hr)**

**PRE-REQUISITES:** F.Sc. or equivalent

### **LEARNING OUTCOMES**

- This course will provide practical knowledge about the statistical applications in Environment
- The students will be able to calculate the measures of central tendency, dispersion and symmetry for different application in environment
- They will practice on distribution fitting and parameter estimation techniques.
- They will become conversant with different software packages and their applications in performing statistical analysis on environmental data.

### **CONTENTS**

This course is designed to make student learn about various statistical analysis on environmental data along with the practical applications on probability distributions, correlation, regression and time series analysis. This course also includes practical applications of different software's packages for statistical analyses in environmental sciences.

#### **Unit-1: Statistical Analysis of Data**

- 1.1. Practical examples on measures of central tendency, dispersion and symmetry
- 1.2. Estimation of correlation of different variables
- 1.3. Practical applications of simple and multiple regression analysis

#### **Unit-2: Probability Distributions**

- 1.1. Distribution fitting
- 1.2. Parameter estimation problems
- 1.3. Comparisons of different frequency distributions goodness of fit analysis

#### **Unit-3: Time series Analysis**

- 1.1. Practical application of time series analysis regarding environmental variables
- 1.2. Modeling of environmental data
- 1.3. Future forecasting of environmental variables

#### **Unit-4: Software Packages for Statistics**

- 1.1. Statistical Analysis using MS Excel
- 1.2. Statistical Package for Social sciences (SPSS)
- 1.3. Introduction to R- Programming for Statically analysis

### **TEACHING – LEARNING STRATEGIES**

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes