2023
TP-153

Course Specification
(Bachelor)

Course Title: Statistical Analysis of Environmental Data (2)
Course Code: STA 1213
Program: Bachelor of Science in Environmental Science
Department: Biology
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University
Version: 2024 – V1
Last Revision Date: None

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A. General information about the course:

1. Course Identification

1. Credit hours: 3 (Lecture 2 + Lab 2 + Tutorial 0)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 3 / Year 2					

4. Course general Description:

The course covers the statistical tests for parametric, non-parametric and binomial data, linear and non-linear regression approaches, Goodness-of-Fit and contingency tables, one-way ANOVA, two-way ANOVA.
Furthermore, students will acquire practical skills in utilizing statistical software tools by engaging in weekly discussions. Students are required to develop proficiency in coding activities, data manipulation, and effectively communicating their quantitative analyses.

5. Pre-requirements for this course (if any)**:**

STA 1112

6. Co-requisites for this course (if any)**:**

7. Course Main Objective(s):

- **Test hypotheses on the different parameters, using the corresponding tests to analyze environmental data.**
- **Compute power and type II error probability** and **make sample size selection decisions for tests on different parameters involving one and two samples.**
- **Apply statistical methods to real-world environmental problems, such as pollution assessment, biodiversity studies, and climate change impact analysis.**
- **Structure comparative experiments involving two samples as hypothesis tests.**
- **Use simple linear and multiple regression for building empirical models that can be used to predict and understand complex environmental systems and phenomena.**
- **Use the chi-square goodness-of-fit test to check distributional assumptions, and contingency table tests.**
- **Understand how the analysis of variance is used to analyze the data from these experiments.**
- **Develop students' ability to effectively communicate statistical findings to both technical and non-technical audiences, emphasizing the importance of data visualization and clear reporting.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning	0	0%
3	Hybrid • Traditional classroom • E-learning	**0**	**0%**
4	Distance learning	**0**	**0%**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**30**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		**60**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	*Course Learning Outcomes*	*Code of CLOs aligned with program*	*Teaching Strategies*	*Assessment Methods*
1.0	**Knowledge and understanding**			
1.1	**To state hypothesis tests in some common models (including Normal models), correctly using the terms null hypothesis, alternative hypothesis, test statistic, rejection region, significance level, power, and p-value.**	**K1, K2**	**Lectures, problem-solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.2	**Describe how correlation is used to identify relationships between variables.**	**K1, K2**	**Lectures, problem-solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
1.3	**Describe how regression analysis is**	**K1, K2**	**Lectures, problem-solving, Classroom discussions**	**Regular Exams, Lab**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	used to predict outcomes.			Assignments, Practical exam
1.4	To state the assumptions for one-way ANOVA, two-way ANOVA the analysis of variance and nonparametric statistics.	K1, K2	Lectures, problem-solving, Classroom discussions	Regular Exams, Lab Assignments, Practical exam
2.0	**Skills**			
2.1	To appraise the results of test hypothesis, linear regression, multiple linear regression analyses using a statistical software package.	S	Lectures, problem-solving, Classroom discussions	Regular Exams, Lab Assignments, Practical exam
2.2	To explain the results of ANOVAs using statistical software for the case of between-subjects, repeated measures, and, when applicable, mixed designs, and conduct appropriate follow-up and simple effects analysis.	S3, S4	Lecturing, Interactive learning.	Assignments, Practical exam
2.3	To differentiate between research questions that require the implementation of statistical analyses.	S2, S3	Lecturing, Interactive learning.	Assignments, Practical exam
2.4	To interpret the results of statistical analysis using a statistical software package.	S1	Lectures, problem-solving, Classroom discussions	Regular Exams, Lab Assignments, Practical exam
3.0	**Values, autonomy, and responsibility**			
3.1	To show collaborative approaches in data analysis projects, valuing diverse perspectives and fostering an inclusive learning environment.	V1	Lectures, problem-solving, Classroom discussions	Regular Exams, Lab Assignments, Practical exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.2	**To draw decisions based on data analysis and understand their findings' broader environmental and social implications.**	**V2**	**Lectures, problem-solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
3.3	**Demonstrate a commitment to ethical standards in data collection, analysis, and reporting, ensuring transparency and integrity in environmental research.**	**V4**	**Lectures, problem-solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction:** Normal Distribution, Sampling distribution of sample statistic, and Interval Estimation–large Samples.	**2**
2	**Hypothesis Testing:** Basics of Hypothesis Testing, Testing a Claim About a Proportion, Testing a Claim About a Mean: σ known, Testing a Claim About a Mean: σ not known, Testing a Claim About Variation. ***Applications using statistical software.***	**10**
3	**Inferences from Two Samples:** Inferences about two Proportions, Inferences about two Means: Independent Samples, Inferences from Dependent Samples, Comparing Variation in two Samples. ***Applications using statistical software.***	**10**
4	**Correlation and Regression:** Correlation, Regression, Variation and Prediction Intervals, Multiple Regression, Modeling. ***Applications using statistical software.***	**10**
5	**Goodness-of-Fit and Contingency Tables:** Goodness-of-Fit, Contingency Tables, McNemar's Test for Matched Pairs. ***Applications using statistical software.***	**10**
6	**Analysis of Variance:** One-Way ANOVA, Two-Way ANOVA. ***Applications using statistical software.***	**8**
7	**Nonparametric Statistics:** Sign Test; Wilcoxon Signed Ranks Test for Matched Pairs; Wilcoxon Ranked-Sum Test for Two Independent Samples; Kruskal-Wallis Test; Rank Correlation; Runs Test for Randomness, ***Applications using statistical software.***	**10**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework, Mini projects	During the semester	15%
2.	Midterm Exam	5th week	25%
3.	Lab exam	14th week	20%
4.	Final Exam	16th week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	***Elementary Statistics***, 14th edition; Mario F. Triola, Pearson, 2022. **(Main Reference).** ***Statistics for Environmental Science and Management,*** 2nd Edition, Bryan F. J. Manly, CRC Press, 2009. **(Main Reference).**
Supportive References	***Analyzing Environmental Data,*** Walter W. Piegorsch, A. John Bailer, John Wiley & Sons, Ltd., 2005.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each classroom should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection.**
Technology equipment (projector, smart board, software)	**The rooms should be equipped with a data show and Smart Board.** **All computers should be equipped with the following software:** • **Microsoft Excel** • **IBM SPSS** • **R-Project**
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Each student will complete two evaluation forms during the semester and at the end of the course.**
Effectiveness of Students assessment	**Instructor**	**At the end of each semester, the course instructor should complete the course report, which includes a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Quality of learning resources	**Students**	**Each student will complete two evaluation forms during the semester and at the end of the course.**
The extent to which CLOs have been achieved	**Instructor**	**At the end of each semester, the course instructor should complete the course report, which includes a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.**
Other	**None**	

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
REFERENCE NO.	
DATE	