هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title :	**Analysis of Variance**
Course Code:	**STA 1325**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**2024 – V1**
Last Revision Date:	**2 October 2024**

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours:					
4 (3 Lectures, 1 Lab, 1 Tutorial)					
2. Course type:					
A.	☐University	☐College	☒ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered:					
Level 5 / Year 3					
4. Course General Description:					
The course on Analysis of Variance (ANOVA) provides a thorough exploration of statistical techniques used to analyze differences among group means. Designed for students with a foundational knowledge of statistics, this course covers both one-way and two-way ANOVA, equipping learners with the skills to determine whether significant differences exist among multiple groups. The curriculum includes a focus on the assumptions underlying ANOVA, such as normality and homogeneity of variance, ensuring students understand the conditions necessary for valid application. Through hands-on experience with statistical software, participants will analyze real data sets, interpret results, and conduct post hoc tests to identify specific group differences. By the end of the course, students will be able to apply ANOVA effectively in various research contexts, enhancing their analytical capabilities and contributing to informed decision-making in their respective fields.					
5. Pre-requirements for this course (if any)**:**					
STA 1224					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
The main objectives of the course on Analysis of Variance (ANOVA) are to provide students with a comprehensive understanding of this essential statistical method and its applications in research. Students will learn the fundamental concepts of ANOVA, including one-way and two-way ANOVA, and when to apply each technique. The course emphasizes interpreting ANOVA results, such as F-ratios and p-values, while also addressing the underlying assumptions of the method, including normality and homogeneity of variance. Practical application is a key focus, as students will engage with real-world data sets using statistical software to enhance their data analysis skills. Additionally, the course covers post hoc testing to identify specific group differences after obtaining significant results. Ultimately, students will gain insights into the role of ANOVA in experimental design and its importance in hypothesis testing and decision-making across various fields.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	***Traditional classroom***	**75**	**100%**
2	***E-learning***	**0%**	**0%**
3	**Hybrid**	**0%**	**0%**

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	***Distance learning***	**0%**	**0%**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	***Lectures***	**45**
2.	***Laboratory/Studio***	**15**
3.	***Field***	**0**
4.	***Tutorial***	**15**
5.	***Others (specify)***	**0**
Total		**75**

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To define the problem and plan experiment.**	**K1, K2**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.2	**To list the main assumptions of ANOVA, and how to identify violations of the assumptions of ANOVA.**	**K1, K3**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Assignments, Practical exam**
1.3	**To outline the components of a two-way ANOVA table and the meaning of sums of squares for rows, columns, and interaction in terms of cell, marginal, and expected means.**	**K2, K3**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Practical exam**
2.0	**Skills**			
2.1	**To analyze and interpret experiments involving multi-group and factorial designs**	**S1, S2**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.2	**To explain analysis of variance (ANOVA) models including conditions and assumptions.**	**S2, S3**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**
2.3	**To justify an appropriate ANOVA model for a given experimental design.**	**S3, S4**	**Lecturing, Interactive learning.**	**Assignments, Practical exam**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.4	**To use the statistical software to carry out the ANOVA analysis.**	**S3, S5**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Assignments, Practical exam**
3.0	**Values, autonomy, and responsibility**			
3.1	**To employ ethical concepts and rules to determine viable alternatives in any given situation.**	**V1, V2**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam, Assignments**
3.2	**To show findings and discuss the results with others.**	**V1, V3**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

C. Course Content

No	List of Topics	Contact Hours
1.	**The Experiment, the Design, and the Analysis:** Introduction to Experimental Design. The Experiment. The Design. The Analysis. Examples.	12
2.	**Single-Factor Experiments with No Restrictions on Randomization:** Introduction. Analysis of Variance Rationale. After ANOVA--What? Tests on Means. Confidence Limits on Means. Components of Variance. Checking the Model. ***Applications using statistical software.***	15
3.	**Single-Factor Experiments:** Randomized Block and Latin Square Designs: Introduction. Randomized Complete Block Design. ANOVA Rationale. Missing Values. Latin Squares. Interpretations. Assessing the Model. Graeco-Latin Squares. Extensions. ***Applications using statistical software.***	16
4.	**Factorial Experiments:** Introduction. Factorial Experiments: An Example. Interpretations. The Model and Its Assessment. ANOVA Rationale. One Observation Per Treatment. ***Applications using statistical software.***	16
5.	**Fixed, Random, and Mixed Models:** Introduction. Single-Factor Models. Two-Factor Models. EMS Rules. EMS Derivations. The Pseudo-F Test. Expected Mean Squares Via Statistical Computing Packages. Repeatability and Reproducibility for a Measurement System. ***Applications using statistical software.***	16
Total		**75**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Homeworks, Quizzes, Mini-projects**	**During the term**	**10%**
2.	**First Midterm**	**Week 5-6**	**25%**
3.	**Second Midterm (lab Exam)**	**Week 10-11**	**25%**

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	**Final Exam**	**Week 16-17**	**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	***Fundamental Concepts in the Design of Experiments***, 5th Edition, Charles R. Hicks, Kenneth V. Turner, Oxford University Press, 1999. ISBN-13: 9780195122732. ***A Student's Guide to Analysis of Variance***; Maxwell Roberts, Riccardo Russo, Routledge, Taylor & Francis Group, 1999. ISBN-13: 9780415165655.
Supportive References	1- ***Design and Analysis of Experiments***; 7th Edition, Douglas C. Montgomery, John Wiley & Sons Inc, 2005. 2- **Applied Linear Statistical Models;** 5th Edition, Chris J. Nachtsheim, Kutner, Chris Nachtsheim, John Neter, Mike Kutner, William Li, McGraw-Hill College, 2005. 3- ***A First Course in Design and Analysis of Experiments***; 1st Edition, Gary W. Oehlert, W H Freeman & Co, 2000.
Electronic Materials	**Course Website: Learning Management Systems (Blackboard)**
Other Learning Materials	**None**

3. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ **Each class room 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 data show and Smart Board.** **All computers should be equipped with the following software:** ▪ **IBM SPSS** ▪ **R-Project** ▪ **Microsoft Excel** ▪ **MATLAB**
Other equipment (depending on the nature of the specialty)	**See the attached file**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student and teaching staff	Surveys and Questionnaires
Effectiveness of Students assessment	Course Coordinator	Peer Reviews
Quality of learning resources	Students and teaching staff	Classroom Observations
The extent to which CLOs have been achieved	Student Representatives	Student Performance Evaluations (exams, projects) CLOs Excel sheet.
Other	None	

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL
REFERENCE NO.	8/1446
DATE	(08/10/2024) 05/04/1446