

Course Content of 500 Zoo (Lectures and Exercises) First semester -1-1448
Dr.Eman Alshehri

Week and Date	Theoretical Lecture	Practical Session	Assignment
1 27-8	Introduction	-	-
2 3-9	Introduction to Study and Experimental Design Research concepts, types of studies, research questions, hypotheses, variables, and experimental units.	Variables and study design Identify the research concept, hypothesis, variables, and appropriate study design.	Assignment_1 Date of Submission 10-9-2026 Before 12:00 Pm
3 10-9	Survey Methods and Biological Sampling Population and sample, sampling principles, random, systematic, and stratified sampling methods.	Sampling Methods Apply different sampling methods and select the most appropriate method for given research scenarios.	-

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4 17-9	Experimental Groups and Randomization Control and experimental groups, replication, randomization, bias, and factors affecting experimental design.	Experimental Groups & Randomization Design control and treatment groups and perform random allocation of experimental units.	-
5 1-10	Data Organization and Descriptive Statistics Types of data, frequency distributions, tables, measures of central tendency and dispersion.	Data Summarization Calculate Mean, Median, SD, SE, Range, and CV and prepare summary tables.	Assignment_2 Date of Submission 8-10- 2026 Before 12:00 Pm
6 8-10	Mid 1 Exam	Project Work	
7 15-10	Data Presentation and Graphical Methods Principles of data visualization and selection of appropriate graphical methods.	Data Visualization Create and interpret histograms, bar charts, boxplots, and scatterplots using a biological dataset.	-

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8 22-10	Introduction to Statistical Tests and Hypothesis Testing Statistical inference, null and alternative hypotheses, p-values, confidence intervals, significance level, assumptions, and an overview of parametric and non-parametric tests.	Statistical Test Overview Identify data types, study designs, and the main statistical tests used for biological data.	-
9 29-10	Choosing the Appropriate Statistical Test Decision-making based on data type, number of groups, independent vs. paired samples, normality, and assumptions.	Statistical Test Selection Select the appropriate test for different biological research scenarios and interpret statistical outputs.	Assignment_3 Date of Submission 5-11-2026 Before 12:00 Pm
10 5-11	Growth Estimation and Animal Experimental Design Growth measurements, growth rate, growth curves, comparison of growth, and principles of animal experimental design.	Integrated Experimental Design Project Design a complete animal experiment including sampling, experimental groups, randomization, data collection, and statistical analysis.	-
11 12-11	Mid 2 Exam	Project Work	

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12 19-11	Project submission
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Assessment Distribution:

Component	Weight
Midterm Exams (2 × 15)	30
Practical Assessment	30
└ Assignments each 5 marks	15
└ IProject	15
Final Exam	40
Total	100

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The Team:

- Dr. Eman Alshehri (Theoretical Lecture)
ealshehri@ksu.edu.sa
Collage of Science -3 Floor -Office 106
Central Research Laboratory – G Floor -Office G20
<https://faculty.ksu.edu.sa/en/ealshehri>

- Dr. Safaa Al-Qurzaei (Practical Session)
salqarzae@ksu.edu.sa
Collage of Science -3 Floor -Office 93
<https://faculty.ksu.edu.sa/ar/salqarzae/cv>

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Research Project

1. Research question
2. Hypothesis
3. Study design
4. Sample size
5. Sampling method
6. Experimental groups
7. Randomization
8. Data collection plan
9. Statistical test selection
10. Data analysis
11. Graphs/tables
12. Statistical interpretation
13. Biological interpretation
14. Ethical considerations
15. Final scientific report

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Project Evaluation (15 Marks)

Criterion	Marks
Research question & hypothesis	2
Experimental design	2
Sampling & sample size	2
Randomization & controls	2
Statistical analysis	3
Data visualization & interpretation	2
Ethics	1
Scientific presentation/report	1
Total	15

Example Project Guide for Students

Research Project

Example Research Topic

Effect of Different Protein Levels on Body Weight Gain in Laboratory Rats

This is an example to demonstrate the expected format. Students should develop their own research question and study.

1. Research Question

Does dietary protein level affect body weight gain in laboratory rats?

2. Hypothesis

Research Hypothesis:

Different dietary protein levels affect body weight gain in laboratory rats.

Null Hypothesis (H_0):

Dietary protein level has no significant effect on body weight gain.

Alternative Hypothesis (H_1):

Dietary protein level significantly affects body weight gain.

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3. Study Variables

Variable	Type	Measurement
Protein level	Independent	Low / Medium / High
Body weight	Dependent	grams
Age	Control variable	weeks
Sex	Control variable	Male
Housing conditions	Control variable	Standardized

4. Experimental Design

The researcher proposes three experimental groups:

Group	Treatment	n
Group 1	Low-protein diet	10
Group 2	Standard-protein diet	10
Group 3	High-protein diet	10

Experimental design:

Completely randomized design.

Control group:

Standard-protein diet.

Experimental groups:

Low- and high-protein diets.

5. Sampling and Randomization

The student should explain:

- Target population
- Study population
- Sample
- Inclusion/exclusion criteria
- Sampling method
- Sample size
- Random allocation of animals to groups

Example:

Thirty eligible animals will be randomly allocated into three groups using a randomization procedure to minimize selection bias.

6. Data Collection

Body weight will be recorded:

- Day 0
- Day 7
- Day 14
- Day 21
- Day 28

The student should prepare a data collection table.

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Animal ID	Group	Day 0	Day 7	Day 14	Day 21	Day 28
R01	Control	180	190	201	210	218
R02	Control	175	185	195	205	214
...	...	...	...	...	...	...

7. Data Analysis Plan

Students should identify the appropriate statistical analyses **before analyzing the data**.

They should consider:

Descriptive statistics

- Mean
- SD
- Range
- CV

Graphical presentation

- Line graph for growth over time
- Boxplot for group comparison

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Inferential analysis

For example, depending on the final study design:

- One-way ANOVA for comparing groups at a specific time point
- Repeated-measures analysis for measurements over time
- Appropriate post-hoc test if required

The student must **justify why the selected test is appropriate.**

8. Statistical Assumptions

The student should assess:

- Normality
- Homogeneity of variance
- Independence
- Outliers

Then state whether the assumptions are satisfied.

9. Statistical Results

Students should present:

Table 1. Descriptive statistics

Figure 1. Growth curves

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Table 2. Statistical test results

Example format:

Mean body weight differed significantly among the three dietary groups at Day 28 ($p < 0.05$).

Students should **not simply report the p-value**. They must explain what the result means biologically.

10. Biological Interpretation

Students should answer:

- Which group showed the greatest growth?
- Was the difference statistically significant?
- Is the difference biologically meaningful?
- What could explain the observed pattern?
- Were there any unexpected findings?

11. Ethical Considerations

The project must address:

- **Replacement**
- **Reduction**
- **Refinement**
- Animal welfare
- Appropriate housing and handling
- Minimization of distress
- Ethical approval requirements

12. Limitations

Students should identify at least **three limitations**, such as:

- Limited sample size
- Short study duration
- Restricted study population
- Potential environmental variation
- Measurement variability

13. Final Conclusion

The conclusion should answer the original research question directly.

Example structure:

The findings suggest that...

The statistical analysis showed...

These findings may indicate...

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Required Project Structure

Students submit their project using the following structure:

- 1. Title**
- 2. Introduction**
- 3. Research Question**
- 4. Hypothesis**
- 5. Objectives**
- 6. Variables**
- 7. Study Design**
- 8. Sampling Method**
- 9. Sample Size**
- 10. Experimental Groups**
- 11. Randomization**
- 12. Data Collection Plan**
- 13. Statistical Analysis Plan**
- 14. Expected Results / Results**
- 15. Tables and Figures**
- 16. Statistical Interpretation**
- 17. Biological Interpretation**
- 18. Ethical Considerations**
- 19. Limitations**
- 20. Conclusion**
- 21. References**

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Deliverables Stages:

Stage	Deadline	Submission
1. Study Proposal	Week 5	Research question, hypothesis, variables & design
2. Analysis Plan	Week 9	Sampling, experimental groups & statistical plan
3. Final Project	Week 12	Complete project with analysis, interpretation & conclusion