



مركز الاعتماد  
وضمان الجودة  
ACCREDITATION & QUALITY ASSURANCE CENTER



**The University of Jordan**

**Accreditation & Quality Assurance Center**

## **Course Syllabus**

**Course Name: Design and  
analysis of experiments**

|    |  |                                    |
|----|--|------------------------------------|
| 1  | Course title   | Design and analysis of experiments |
| 2  | Course number  | 0341336                            |
| 3  | Credit hours (theory, practical)                     | 3                                  |
|    | Contact hours (theory, practical)                    | 3                                  |
| 4  | Prerequisites/corequisites                           |                                    |
| 5  | Program title  | B.Sc Mathematics                   |
| 6  | Program code   |                                    |
| 7  | Awarding institution                                 | The University of Jordan           |
| 8  | Faculty  | Faculty of Science                 |
| 9  | Department   | Mathematics Department             |
| 10 | Level of course                                      | 300-level                          |
| 11 | Year of study and semester (s)                       |                                    |
| 12 | Final Qualification                                  |                                    |
| 13 | Other department (s) involved in teaching the course | None                               |
| 14 | Language of Instruction                              | English                            |
| 15 | Date of production/revision                          | 14/11/2017                         |

#### 16. Course Coordinator:

*Office numbers, office hours, phone numbers, and email addresses should be listed.*

Professor Hisham Hilow  
hilow@ju.edu.jo

#### 17. Other instructors:

*Office numbers, office hours, phone numbers, and email addresses should be listed.*

Professor Ahmad Zgoul  
Dr Amal Helu

#### 18. Course Description:

*As stated in the approved study plan.*

. Basic ideas and tools for good experimentation: Randomization, Blocking and Replication. One way and 2-way completely randomized designs for fixed / random effects experiments. Analysis of Variance, Comparison of Multiple Treatment Means and the Generalized Type I error rate. Orthogonal contrasts. Simple Linear regression and The Analysis of covariance. Hierarchical (nested ) designs. Randomized Complete and Incomplete Block Designs. Latin square and Cross-over

designs.

### 19. Course aims and outcomes:

#### A- Aims:

This course is about concepts and techniques employed in designing and analyzing experiments for the purpose of controlling and accounting for variability in experimental data.

Therefore, the aim of this course is to introduce student to the principles and methods for designing experiments and analyzing experimental data , where the course will discuss (i)how to design good experiments controlling for all sources of variability , (ii) carry them out to generate experimental data and finally (iii) analyze the data they yield to quantify and describe the effects of all factors influencing the conduct of the experiment. Students will also gain experience with statistical packages ( SAS ,SPSS and MINITAB) to help them conduct the necessary statistical analysis then formulate conclusions and generalizations about the problems studied and experimented.

It is worth noting that experiments are conducted in almost all fields of science to solve real life problems and to propose new innovations in order to make human life easier and more enjoyable. Experiments vary in structure and complexity. Therefore, each experiment must be conducted according to an optimal design and collected data there-from are optimally analyzed by analysis of variance techniques using an optimal linear model to maximize the information about the problem investigated. Linear models relate mathematically input variables affecting the conduct of the experiment with output responses so that cause –effect relationships effects could be measured and quantified between inputs and outputs.

**B- Intended Learning Outcomes (ILOs):** Upon successful completion of this course students will be able to ...

Having successfully completed this course each student will be able to:

- (1) understand issues and principles of Design of Experiments and also understand that experimentation is a process starting with identification of the problem and formulating hypotheses, then designing to investigate the problem experimentally and finally analyze collected experimental data to formulate conclusions and make generalizations.
- (2) apply the three principles for designing experiments : randomisation, replication and stratification ( i.e. blocking) to practical problems involving experimentation and data collection.
- (3) explore the general theory of factorial and block designs to find and propose appropriate designs for specific applications.
- (4) evaluate designs using common optimality criteria and use these criteria to compare competing designs.
- (5) Apply experimental design theory for any experimental design structure and its corresponding analytical methods for any experimental application.
- (6) Efficiently use statistical software packages to analyze data from different forms of experiments.
- (7) **write reports in non-technical language summarizing results of statistical analysis of all forms of experimental data.**

### 20. Topic Outline and Schedule:

| Topic  | Week | Instructor | Achieved ILOs | Evaluation Methods                       | Reference |
|--|------|------------|---------------|--|-----------|
| Basic principles of experimental design: randomization , replication and | 1-2  |            | 1-7           | Homework Assignments And Reports Writing |           |

|   |       |  |     |  |  |
|---|-------|--|-----|--|--|
| blocking<br>(paired and unpaired designs)   |       |  |     |  |  |
| One-way Completely randomized designs and their ANOVA and Multiple comparisons Fixed and random effects models Sub- | 3-5   |  | 1-7 | Homework Assignments And Reports Writing             |  |
| Simple Regression and Analysis of Covariance  | 6-7   |  | 1-7 | First Exam   |  |
| Two-way completely randomized designs and their ANOVA Interaction analysis  | 8-10  |  | 1-7 | Homework Assignments And Reports Writing             |  |
|   |       |  |     |  |  |
| Randomized complete and incomplete block designs and Latin Square designs   | 11-13 |  | 1-7 | Homework Assignments And Reports Writing Second Exam |  |
| Sub-sampling experimental units and Nested designs and their ANOVA Cross-over designs and repeated measurements     | 14-15 |  | 1-7 |  |  |

## 21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

The course will be conducted combining class lectures ,computer sessions and student presentations

## 22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Students taking this course will be evaluated by two midterm exams and project presentation accounting for 50% of the total grade then a Final written exam accounting for 50% of the total grade.

## 23. Course Policies:

### A- Attendance policies:

Consistent attendance is mandatory and critical to success in the course. Missing a class means missing a lot of important course content, class discussions and instructions regarding homework assignments, reading and tests.

### B- Absences from exams and handing in assignments on time:

Unless each student make prior arrangements to his/her absence or have a documented excusable absence he/she will receive a zero for missed exams. Students with excusable absences will be expected to take the exam immediately upon returning to class.

### C- Health and safety procedures:

The following are only excusable absences from attending classes or exams:

- (i) death in immediate family (ii) Doctor-documented medical illness
- (ii) heavy rain or snow causing traffic closure

### D- Honesty policy regarding cheating, plagiarism, misbehavior:

Academic dishonesty is unacceptable in the course and at campus. Students caught cheating, plagiarizing, submitting the same work of other persons as your own will be met with disciplinary action. Please refer to the university's academic handbook for this regard.

### E- Grading policy:

First Exam 20% Second Exam 30% and Final Exam 50%

### F- Available university services that support achievement in the course:

The department computer lab will be utilized for conducting all necessary statistical analysis

## 24. Required equipment:

Statistical packages like SAS ,SPSS ,MINITAB

**25. References:**

A- Required book (s), assigned reading and audio-visuals:

(i) Design and Analysis of Experiments, 9<sup>th</sup> edition  
Douglas C. Montgomery  
Wiley 2017

(ii) Design and Analysis of Experiments, 2<sup>th</sup> edition  
Angelea Dean, Daniel Voss and Danel Draguljic  
Springer Verlag

(iii) Design and Analysis of Experiments, 2<sup>th</sup> edition  
Klaus Hinkelmann and Oscar Kempthorne  
Wiley

B- Recommended books, materials, and media:

**26. Additional information:**

Name of Course Coordinator: ---Dr.Hisham Hilow-----Signature: ----- Date: -----

----- Head of curriculum committee/Department: ----- Signature: -----

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Head of Department: ----- Signature: -----

Head of curriculum committee/Faculty: ----- Signature: -----

Dean: ----- -Signature: -----

Copy to:

Head of Department  
Assistant Dean for Quality Assurance  
Course File