هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

# Course Specification
— (Bachelor)

**Course Title:** Introduction to Probability and Statistics

**Course Code:** STA 1111

**Program:** Bachelor of Science in Chemistry

**Department:** Chemistry

**College:** Science

**Institution:** Imam Mohammad Ibn Saud Islamic University

**Version:** 2024 – V1

**Last Revision Date:** None

## Table of Contents

## A. General information about the course:

### 1. Course Identification

#### 1. Credit hours:
3 (2 Lectures, 0 Lab, 2 Tutorial)

#### 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:

This course describes the most important ideas, theoretical results, and examples of descriptive statistics, counting, random variables probability distributions. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned. The use of statistical packages is essential during this course.

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

MAT 1101

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

None

#### 7. Course Main Objective(s):

- **Describe discrete data graphically and compute measures of centrality and dispersion.**
- **Compute probabilities by modeling sample spaces and applying rules of permutations and combinations, additive and multiplicative laws and conditional probability.**
- **Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance.**
- **Compute probabilities based on practical situations using the discrete and continuous distributions.**

### 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|----|---------------------|---------------|------------|
| 1 | Traditional classroom | 60 | 100% |
| 2 | E-learning | 0 | 0% |
| 3 | Hybrid<br>• Traditional classroom<br>• 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 | 0 |
| 3. | Field | 0 |
| 4. | Tutorial | 30 |
| 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 | Describe the various measures of central tendency and dispersion. | K1 | Use of statistical software, Lecturing, Interactive learning. | Direct: Lab Exam, Assignments, Practical exam |
| 1.2 | Outline basic probability concepts and techniques of counting for the calculation of probabilities. | K3 | Lecturing, Interactive learning. | Direct: Assignments, Practical exam |
| **2.0** | **Skills** | | | |
| 2.1 | Analyze data using tables and charts. | S1, S2 | Use of statistical software, Lecturing, Interactive learning. | Direct: Lab Exam, Assignments, Practical exam |
| 2.2 | Produce descriptive summary measures for a population and the coefficient of correlation. | S2, S3 | Use of statistical software, Lecturing, Interactive learning. | Direct: Lab Exam, Assignments, Practical exam |
| 2.3 | Compute probabilities from the binomial, geometric, Poisson, and hypergeometric distributions. | S3 | Lecturing, Interactive learning. | Direct: Assignments, Practical exam |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|------|--------------------------|-----------------------------------|---------------------|---------------------|
| 2.4 | Deduce probability mass functions, the expected value and variance for discrete random variables. | S1, S2 | Lecturing, Interactive learning. | Direct: Assignments, Practical exam |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| 3.1 | Argue the formulated conclusions. | V2 | Personal questions | Direct: Participation |
| 3.2 | Debate meaningfully and productively with others. | V2 | Teamwork and class discussions. | Direct: Homework and Mini projects |

## C. Course Content

| No | List of Topics | Contact Hours |
|----|----------------|---------------|
| 1 | **Descriptive Statistics**<br>**Definitions:** Statistics, Population, Sample, parameter, Statistic.<br>• **Data Organization and Frequency Distributions:** Data Raw, The Data Array, Frequency Distributions.<br>• **Computing Measures of Central Tendency:** Measuring Central Tendency for Ungrouped Data: The Arithmetic Mean, The Median, The Mode, The Geometric Mean and Harmonic Mean.<br>• **Computing Measures of Dispersion and Relative Position:** Measuring Dispersion for Ungrouped Data: The Range, The Variance and Standard Deviation and Coefficient of Variation.<br>• **Introduction to Linear Regression:** Simple Linear Regression and Correlation. | 12 |
| 2 | **Probability Theory**<br>• **Sample Spaces and Events:** Random Experiments, Sample Spaces, Events.<br>• **Interpretations and Axioms of Probability.**<br>• **Addition Rules.**<br>• **Conditional Probability.**<br>• **Multiplication and Total Probability Rules.**<br>• **Independence.** Bayes' Theorem. | 12 |
| 3 | **Random Variables and Probability Distributions**<br>• **Concept of Random Variable.**<br>• **Discrete Random Variables.**<br>• **Probability Distribution and Probability Mass Functions.**<br>• **Cumulative Distribution Functions.**<br>• **Mean and Variance of a Discrete Random Variable.**<br>• **Continuous Random Variables.**<br>• **Probability Distributions and Probability Density Function.**<br>• **Cumulative Distribution Functions.** | 12 |

| | | |
|---|---|---|
| | • Mean and Variance of continuous Random Variable. | |
| 4 | **Some Discrete Probability Distributions**<br>• **Bernoulli trial**<br>• **Binomial Distribution.**<br> • **Hypergeometric Distribution.**<br> • **Poisson Distribution.** | **12** |
| 5 | **Some Continuous Probability Distributions**<br>• **Continuous Uniform Distribution.**<br> • **Normal Distribution.**<br>• **Areas Under the Normal Curve**<br>• **Applications of the Normal Distribution**<br> • **Normal Approximation to the Binomial Distribution.**<br> • **Exponential Distribution** | **12** |
| **Total** | | **60** |

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | **HomeWorks, Quizzes, Mini projects** | **During the semester** | **10%** |
| 2. | **First Midterm** | **Week 5-6** | **25%** |
| 3. | **Second Midterm** | **Week 10-11** | **25%** |
| 4. | **Final Exam** | **Week 15** | **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: A Step By Step Approach*, 10th Edition, Allan Bluman, Mc Graw Hill, 2018. ISBN13: 9781259755330 **(Main Reference)**. |
| **Supportive References** | 1- *Elementary Statistics,* 14th edition; Mario F. Triola, Pearson, 2021.<br>2- *Introduction to Probability and Statistics*; 14th Edition, W. Mendenhall, R. J. Beaver, Barbara M. Beaver, Duxbury Press, 2013.<br>3- *Applied Probability and Statistics in Engineering,* 4th Edition, William W. Hines, Douglas C. Montgomery, David M. Goldsman, Connie M. Borror, John Wiley & Sons Inc, 2003.<br>4- *Probability and Statistics for Engineering and the Sciences,* 9th Edition, Jay L. Devore, Brooks/Cole, Cengage Learning, 2016. |

| | |
|---|---|
| | **5- *Data Analysis with Microsoft Excel***, 3rd Edition, Kenneth N. Berk, Patrick Carey, Duxbury Press, 2010. |
| **Electronic Materials** | **None** |
| **Other Learning Materials** | **None** |

## 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities**<br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | ▪ **Each classroom should be equipped with a whiteboard and a projector.**<br>▪ **Laboratories should be equipped with computers and an internet connection.** |
| **Technology equipment**<br>(projector, smart board, software) | **The rooms should be equipped with data show and Smart Board.**<br>**All computers should be equipped with the following software:**<br>• **Microsoft Excel**<br>• **IBM SPSS**<br>• **R-Project**<br>• **MATLAB** |
| **Other equipment**<br>(depending on the nature of the specialty) | **None** |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | **Students** | **During the semester and at the end of the course each student will complete two evaluation forms.** |
| Effectiveness of Students' assessment | **Instructor** | **At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.** |
| Quality of learning resources | **Students** | **During the semester and at the end of the course each student will complete two evaluation forms.** |
| The extent to which CLOs have been achieved | **Instructor** | **At the end of each semester the course instructor should complete the course report, including a summary of student questionnaire responses appraising progress and identifying changes that need to be made if necessary.** |

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| 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.** | **4/1446** |
| **DATE** | **06/03/1446 (09/09/2024)** |