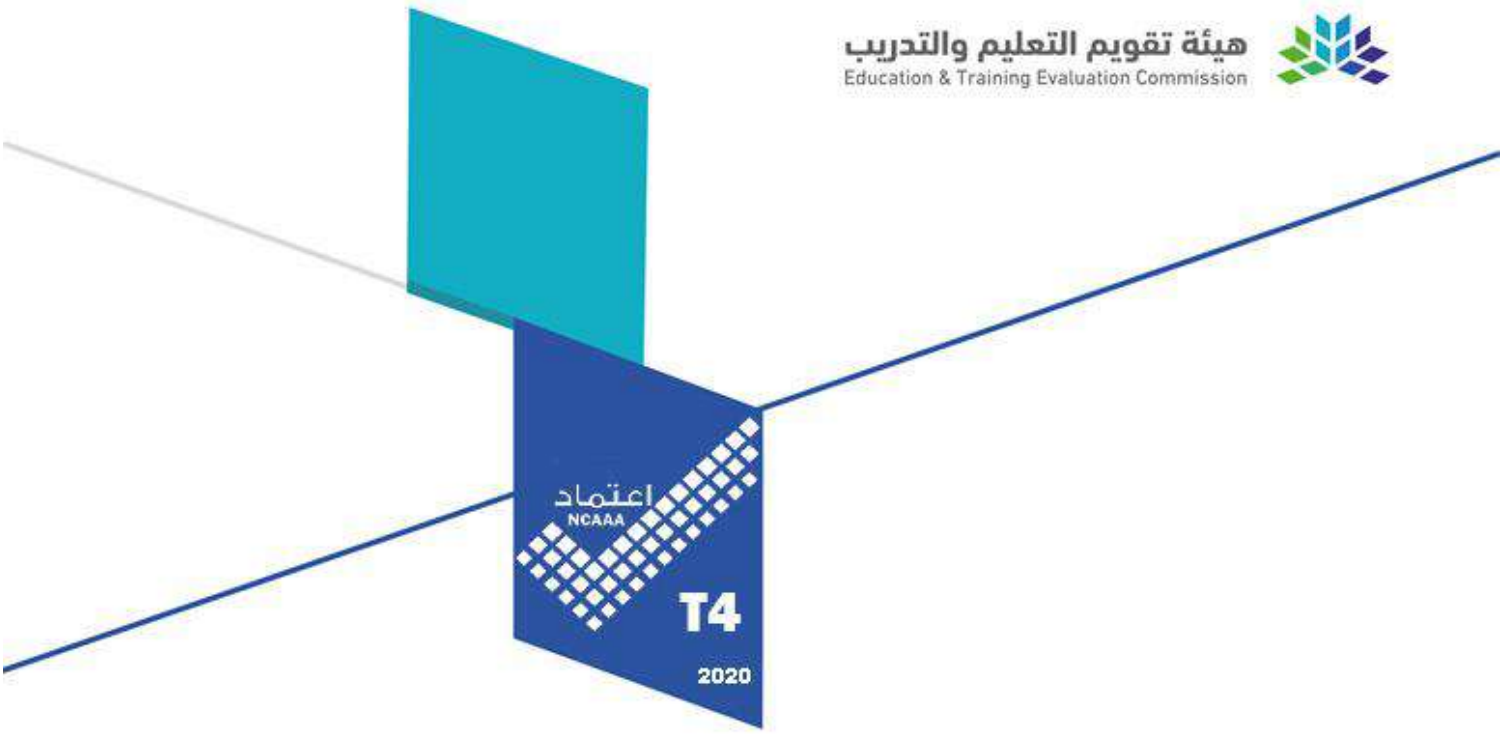
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Mathematical Statistics**
Course Code:	**STA 1203**
Program:	**Bachelor of Science in Applied Statistics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3 Lectures, 0 Lab, 2 Tutorial)**
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**Level 6 / Year 2**
4. Pre-requisites for this course (if any):	**STA 1202**
5. Co-requisites for this course (if any):	**None**

6. Mode of Instruction (mark all that apply)

No	*Mode of Instruction*	*Contact Hours*	*Percentage*
1	**Traditional classroom**	**60**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	*Activity*	*Contact Hours*
1	**Lecture**	**36**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**24**
4	**Others** (specify)	**0**
	Total	**60**

B. Course Objectives and Learning Outcomes

1. Course Description

This course describes the most important ideas, theoretical results, and examples of bivariate probability distributions, sampling distributions and the CLT, functions of random variables, parameter estimations and hypothesis testing. The course includes the essential fundamentals of these topics. The emphasis is on calculations, and some applications are mentioned.

2. Course Main Objective

- **Use joint probability mass functions and joint probability density functions to calculate probabilities;**
- **Calculate means and variances for linear combinations of random variables.**
- **Determine the distribution of a general function of a random variable;**
- **Calculate moment generating functions and use the functions to determine moments and distributions;**
- **Understand the central limit theorem;**
- **Know how to compute and explain the precision with which a parameter is estimated;**
- **Construct confidence intervals on the mean, variance, standard deviation and population proportion.**
- **To teach students techniques of estimations.**

3. Course Learning Outcomes

	CLOs	*Aligned-PLOs*
1	**Knowledge and Understanding:**	
1.1	**To define the moment generating function, the joint probability mass functions, and joint probability density functions.**	**K1, K2**
1.2	**To reproduce the confidence intervals on the mean, variance, standard deviation and on a population proportion.**	**K1, K2**
2	**Skills:**	
2.1	**To explain the importance of central limit theorem**	**S1, S2**
2.2	**To calculate means and variances for linear combinations of random variables.**	**S4**
2.3	**To construct confidence intervals on the appropriate case.**	**S2, S3**
2.4	**To explain important properties of point estimators, including bias, variance, and mean square error**	**S5**
2.5	**To construct point estimators using the method of moments and the method of maximum likelihood.**	**S3**
3	**Values:**	
3.1	**To defend the formulated conclusions individually.**	**V1, V2**
3.2	**To operate meaningfully and productively with others.**	**V1, V3**

C. Course Content

No	List of Topics	Contact Hours
1	**Bivariate Probability Distribution:** Two Discrete Random Variables, Two Continuous Random Variables, Covariance and Correlation, Bivariate Normal Distribution, Linear Combinations of Random Variables.	**6**
2	**Sampling distributions and the central limit theorem:** Sampling distributions, Sampling Distributions of the Means, The chi-square distribution, The t distribution, The F distribution.	**6**
3	**Functions of Random Variables:** Finding the probability distribution of a function of random variable. The method of distribution function, The method of transformations, Using the Moment-Generating Functions	**8**
4	**Sampling Distributions and The Central Limit Theorem:** Sampling Distributions related to the Normal Distribution; The Central Limit Theorem; A proof of the Central Limit Theorem.	**8**
5	**Estimation: Point estimation:** The Bias and Mean Square Error of Point Estimation; Some Common Point Estimators; Evaluating The goodness of a Point Estimator.	**8**
6	**Confidence Interval Estimation:** Confidence interval for the Mean when σ is Known: Confidence interval for the Mean when σ is Unknown. Confidence Interval and Sample Sizes for Proportions. Confidence Intervals for Variance And standard Deviations.	**15**
7	**Properties of Point Estimators and Methods of Estimation:** Relative Efficiency. Consistency. Sufficiency. Rao-Blackwell Theorem and Minimum Variance Estimation. The Method of Moments. The Method of Maximum Likelihood.	**9**
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**To define the moment generating function, the joint probability mass functions, and joint probability density functions.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Short Quizzes**
1.2	**To reproduce the confidence intervals on the mean, variance, standard deviation and on a population proportion.**	**Lectures, problem solving, Classroom discussions**	**Regular Exams, Lab Assignments, Short Quizzes**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.0	**Skills**		
2.1	**Explain the importance of central limit theorem**	**Lecturing, Interactive learning.**	**Participations, Short Quizzes**
2.2	**Calculate means and variances for linear combinations of random variables and calculate probabilities for linear combinations of normally distributed random variables**	**Lecturing, Interactive learning.**	**Participations, Short Quizzes**
2.3	**Construct confidence intervals on the appropriate case.**	**Lecturing, Interactive learning.**	**Participations, Short Quizzes**
2.4	**To explain important properties of point estimators, including bias, variance, and mean square error**	**Use of statistical software, Lecturing, Interactive learning.**	**Lab Exam, Participations, Short Quizzes**
2.5	**To construct point estimators using the method of moments and the method of maximum likelihood.**	**Lecturing, Interactive learning.**	**Participations, Short Quizzes**
3.0	**Values**		
3.1	**To defend the formulated conclusions individually.**	**Interactive learning, Group interaction, Problem solving.**	**Lab Exam, Practical exam**
3.2	**To operate meaningfully and productively with others.**	**Group interaction, Problem solving.**	**Assignments and Mini-projects**

2. Assessment Tasks for Students

#	*Assessment task**	*Week Due*	*Percentage of Total Assessment Score*
1	**Homeworks, Quizzes, Mini-projects**	**During the semester**	**20%**
2	**First Midterm**	**Week 4-5**	**20%**
3	**Second Midterm**	**Week 7-8**	**20%**
4	**Final Exam**	**Week 13**	**40%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **There are 6 office hours per week reserved by each professor, planed on his timetable, to help the students on their problems.**
- **All department students are assigned two academic advisors who will act as a mentor, providing academic and career advice, and general counseling.**

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	***Probability & Statistics for Engineers & Scientists***, 9th Edition, R. Walpole, R. Myers, S. Myers, K. Ye, Pearson Education International, 2012. ISBN 9780321629111. **(Main Reference).** ***Introduction to Mathematical Statistics***, 6th Edition, Robert V. Hogg, Joseph McKean, Allen T. Craig, Prentice Hall, 2005. **(Main Reference).**
Essential References Materials	1. ***Mathematical Statistics with Applications,*** 7th Edition, D. Wackerly, W. Mendenhall, R.L. Scheaffer, Brooks/Cole-Cengage Learning, 2008. ISBN-13: 9780495385080. 2. ***Probability and Statistics in Engineering***, 4th Edition, William W. Hines, Douglas C. Montgomery, David M. Goldsman, Connie M. Borror, John Wiley & Sons Inc, 2003. ISBN: 9780471240877. 3. ***Introduction to Mathematical Statistics***, 6th Edition, Robert V. Hogg, Joseph McKean, Allen T. Craig, Prentice Hall, 2005.
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	*Resources*
Accommodation *(Classrooms, laboratories, demonstration rooms/labs, etc.)*	▪ **Each class room should be equipped with a whiteboard and a projector.** ▪ **Laboratories should be equipped with computers and an internet connection (Equipped with Microsoft Excel and SPSS).**

Item	*Resources*
Technology Resources *(AV, data show, Smart Board, software, etc.)*	**The rooms should be equipped with data show and Smart Board.** **All computers should be equipped with the following software:** ▪ **Microsoft Excel** ▪ **IBM SPSS** ▪ **R-Project** ▪ **MATLAB**
Other Resources *(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)*	**See the attached file**

G. Course Quality Evaluation

Evaluation Areas/Issues	*Evaluators*	*Evaluation Methods*
Effectiveness of teaching and assessment, Quality of learning resources	**Students**	**During the semester and at the end of the course each student will complete two evaluation forms.**
Extent of achievement of course learning outcomes, Quality of learning resources	**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.**

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**MATHEMATICS AND STATISTICS DEPARTMENT COUNCIL**
Reference No.	**11/1444**
Date	**22/04/1444 (16/11/2022)**