هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title:	**Statistical Inference**
Course Code:	**STA 1231**
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, 0 Lab, 2 Tutorial)					
2. Course type:					
A.	☐University	☐College	☒ Program	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered:					
Level 4 / Year 2					
4. Course General Description:					
In statistics, the estimation theory is fundamental in order to analyze real as well as simulated data. The course covers basic concepts of random samples, principle of data reduction, methods of finding estimators, methods of evaluating estimators, unbiased estimators, methods of finding tests, methods of evaluating tests, most powerful tests, interval estimations, confidence coefficient or level, Bayesian procedure methods of evaluating interval estimators, maximum likelihood method.					
5. Pre-requirements for this course (if any):					
STA 1261					
6. Co-requisites for this course (if any):					
None					
7. Course Main Objective(s):					
The objectives of this course will be to integrate mathematical statistics. Specifically, this course will further develop estimation theory (point and interval) estimation and tests of hypotheses, including hypothesis testing, information approach to hypothesis testing, uniformly most powerful and likelihood ratio tests.					

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** • Traditional classroom • E-learning	**0**	**0%**
4	***Distance learning***	**0**	**0%**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
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 state the notions of point estimation and interval estimation and different methods of finding and evaluating interval estimators.**	**K1, K2**	**Lectures, problem solving, Classroom discussions**	**Direct:** Regular Exams, Assignments, Short Quizzes
1.2	**To define the concepts of random sample, principle of data reduction, best unbiased estimator, likelihood ratio test, and the maximum likelihood test.**	**K1, K3**	**Lectures, Problem solving, Classroom discussions**	**Direct:** Regular Exams, Assignments, Short Quizzes
2.0	**Skills**			
2.1	**To use Bayes formula to find the posterior, knows the concepts of a prior and posterior distribution, and understands the concept of a conjugate prior distribution**	**S1, S2**	**Lecturing, Interactive learning.**	**Direct:** Regular Exams, Assignments, Short Quizzes
2.2	**To determine properties of estimators.**	**S3**	**Lecturing, Interactive learning.**	**Direct:** Regular Exams, Assignments, Short Quizzes
2.3	**To choose optimal estimators.**	**S3, S4**	**Lecturing, Interactive learning.**	**Direct:** Assignments, Short Quizzes
2.4	**To implement methods of statistical inference for discrete data.**	**S5**	**Lectures, Problem solving, Classroom discussions**	**Direct:** Regular Exams, Assignments, Short Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	**To work individually.**	**V1, V2**	**Interactive learning, Group interaction, Problem solving.**	**Direct:** Participation
3.2	**To operate meaningfully and productively with others.**	**V1, V3**	**Group interaction, Problem solving.**	**Direct:** Assignments and Mini-projects

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction:** Probability distributions, Exponential Families, Locations and Scale Families.	10
2	**Random Sample:** Basic Concepts of Random Samples. Central Limit Theorem. Order Statistics. Generating a Random Sample.	9

No	List of Topics	Contact Hours
3	**Principles of Data Reduction:** Introduction. The Sufficiency Principle. The Likelihood Principle. The Equivariance Principle.	14
4	**Point Estimation:** Introduction. Methods of Finding Estimators. Methods of Evaluating Estimators. Best Unbiased Estimator or Uniform Minimum Variance Unbiased Estimator, The Cramer-Rao Inequality, Attaining the Lower Bound. The Rao-Blackwell Theorem, Characterizing Best Unbiased Estimators.	14
5	**Hypothesis Testing:** Introduction. Methods of Finding Tests. Methods of Evaluating Test. Most Powerful Tests: The Neyman-Pearson Lemma, Karlin-Rubin Theorem, The Likelihood Ratio Test, Union and Intersection Tests. **Tests of Statistical hypotheses**, principles and definitions, the null and alternative hypotheses, types of errors, the power of a test, testing of hypothesis about: Population mean, proportion, and the variance. Hypothesis testing about two independent samples and paired samples.	14
6	**Interval Estimation:** Introduction. Methods of Finding Interval Estimators. Methods of Evaluating Interval Estimators. Confidence Coefficient or Level, Procedures based on Hypothesis Test Rejection Regions, on Pivotal Quantities, CDFs, Bayesian Procedures Methods of Evaluating Interval Estimators: Length, Optimality via Test Equivalence, Bayesian Optimality, Optimality via Loss Functions. **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. Confidence Interval for the Difference Between Two Population Means.	14
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**	**Week 10-11**	**25%**
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	**Statistical Inference,** Roger L. Berger, George Casella, Duxbury Press, 2001.
Supportive References	1- ***Introduction to Probability and Statistics,*** William Mendenhall, Robert J. Beaver, Barbara M. Beaver, Duxbury Press (Thomson Brooks), 2006. 2- ***Mathematical Statistics with Applications,*** Richard L. Scheaffer, Dennis D. Wackerly, William Mendenhall, Duxbury Press (Thomson Brooks), 2007.

	3- ***Introduction to Mathematical Statistics***, 6th Edition, Robert V. Hogg, Joseph McKean, Allen T. Craig, Prentice Hall, 2005.
Electronic Materials	**Course Website: Learning Management Systems (Blackboard)**
Other Learning Materials	**None**

2. 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:** ▪ **Microsoft Excel** ▪ **IBM SPSS** ▪ **R-Project** ▪ **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**