Department of Mathematics

College of Education

University of Salahaddin

Subject: Mathematical Statistics

Course Book : Third year Mathematics

Lecturer's name : Awaz Kakamam Muhammad

Academic Year: 2023/2024

Course Book

1. Course name	Mathematical Statistics
2. Lecturer in charge	Awaz Kakamam Muhammad
3. Department/ College	Mathematics / Education
4. Contact	Awaz.mum@su.edu.krd Tel: (optional)
5. Time (in hours) per week	Theory: 3 hours
6. Office hours	Sunday 12:00-2:30 Tuesday 10:00-12:30, Thursday 10:00-11:30
7. Course code	
8. Teacher's academic profile	Awaz Kakamam Muhammad, PhD in applied Mathematics, Lecturer, I am working in Mathematics Department College of Education, Salahaddin University *Qualifications:* PhD in applied Mathematics and Statistical Analysis of Big Data sets (2018), University of Leicester-UK. MSc in Algebra (2010), Salahaddin University-Erbil, Iraq. BSc in Mathematics (2004), Salahaddin University-Erbil, Iraq. **Teaching Experience:** From 2004 I worked as an assistant lecturer, and then a lecturer at Mathematics Department/ College of Education/ Salahaddin University-Erbil/Iraq *Languages:* • English • a few Arabic • Kurdish *Publications:* Published papers mostly in applied statistics and data analysis. Several papers are published in algebra. One my useful and wonderful books is published and now it is available in Springers.
9. Keywords	Probability Theory, Distribution of Random Variables, Transformation, Order statistics, F-

	distribution, Student t-dist. Estimation ,Sufficiency, consistency, efficiency, MVUE.

10. Course overview:
Mathematical Statistics course is designed as one of the main core courses for third year undergraduate students with prior knowledge of basic statistics (Descriptive Statistics) and probability theory. It is continuation for the previous year course "Introduction to Statistics and Probability Theory", starting with a comprehensive revision of the main concepts of statistics and probability theory then the rest of the course will be devoted to Transformation, Order statistics, F-distribution, Student t-distribution, order statistics, sampling theory and then statistical inference, which includes estimation, likelihood, Sufficiency, consistency, efficiency and MVUE. This will introduce students to elements of statistical inference and help them understand the role of statistical inference in solving real life problems.

11. Course objective: To provide students with a solid grounding in probability theory and mathematical statistics of statistical inference. The student is introduced to sampling theory and methods of estimation and hypothesis testing.

12. Student's obligation: Students should attend lectures and consideration will be given to attendance. There will be two examinations and a comprehensive final examination. Announced and unannounced quizzes may be given. Various homework exercises (assignments), which are used in grading, are given weekly.

13. Forms of teaching: For this course, different forms of teaching methods such as the lecture method, multimedia presentations, group discussions, and spreadsheet assignments will be used throughout the course. Work will be done individually and/or in small groups. The primary focus of the teaching methodologies used will be to prepare the student to understand distribution function of random variables, order statistics and sampling theory, and then introduce students to main concepts of statistical inference, which will help them apply the statistical tools learned to real life situations. Thus enough time will be devoted to interactive learning and problem solving. The readings will come from the required text books as well as additional references such as internet resources and other to be provided by the instructor. Lectures and tutorials will enable the instructor and students to expand on the material presented in the readings.

14. Assessment scheme : For this course different assessment measures are considered such as quizzes, graded homework and exams, building up to a comprehensive final exam. The final grade is calculated as follows: Exams: 30% , Homework and interactive activities: 10% , Final Exam: 60%.

15. Student learning outcome: As a result of successfully completing this course, the student will possess a basic understanding of descriptive and inferential statistics to provide statistical background for sampling theory and combination and drawing inferences for the populations under study. Finally, the student will be capable of utilizing Random Sampling Distribution theory to conduct basic hypothesis tests to assess assumptions. Moreover, it helps fourth year undergraduate students studying Applied Statistics and learns how to explore and handle data in a systematic manner.

16. Course Reading List and References:
   1) Hogg, R. V., McKean, J. W., & Craig, A. T. (2019). *Introduction to Mathematical Statistics* 8th Edition, Macmillan, New York.

2) Hogg, R. V., Tanis, E. A., & Zimmerman, D. L. (1977). *Probability and statistical inference* (Vol. 993). New York: Macmillan.
3) Wackerly, D., Mendenhall, W. and Scheaffer, R.L., 2014. *Mathematical statistics with applications.* Cengage Learning.
4) Larson, R. And Marx, M. (2006), *Introduction to Mathematical Statistics and Applications,* London, Pearson education Ltd.

Note: For this course, other references such as books or internet links on mathematical statistics

17. The Topics: The course topics, which will be Presented throughout this academic year, are outlined weekly as follows:	**Lecturer's name**
Week 1&2: Introduction to statistics and probability theory; (Review) **Week 3 & 4:** Distribution for R.Vs, Transformation of variables; **Week 5:** the t and F distributions, examples; **Week 6:** Order Statistics and examples; **Week 7:** Estimation, Point Estimation; **Week 8 & 9:** The point and interval estimation, Criteria for good estimators, The Bias and Mean-Square error of point estimators, Mean-Square error (MSE) **Week 10:** Efficiency of estimator, Sufficiency, Sufficient estimation **Week 11 & 12:** Minimum Variance Unbiased Estimation, Likelihood, Factorization Theorem (Factorization Criterion), Fisher Information, ; **Week 13&14:** Consistency, Rao–Blackwell Theorem; **Week 15:** Methods of Moments and Maximum Likelihood Estimation, applications; **Week 16:** Measures of quality of estimation, main properties and examples; **Week 17, 18:** Interval estimation, confidence intervals for means, variances, differences of means, examples; **Week 19, 20**: Statistical hypothesis, basic definition, Null/Alternative Hypothesis, examples; **Week 21:** Critical Value, One/Two Tail Tests, examples; **Week 22:** Probability of Type One/Two Error, examples **Week 23:** Certain best tests;	**Awaz Kakamam**

Week 24: Uniformly most powerful test and examples **Week 25:** Likely ratio test **Week 26 & 27:** Examples and Applications.	
18. Practical Topics (If there is any)	
19. Examinations:	
20. Extra notes:	