# KARATINA UNIVERSITY

## SCHOOL OF PURE AND APPLIED SCIENCES

## DEPARTMENT OF MATHEMATICS, STATISTICS & ACTUARIAL SCIENCE

## COURSE OUTLINE

| Course Code: | **ACS 412** |
|---|---|
| **Course Title:** | **Survival Models and Analysis** |
| **Program(s):** | BSc in Actuarial Science |
| **Year and semester** | Y4S1 |
| **Lecturer Name:** | Prof. J.K. Kinyanjui |
| **Lecturer Contacts:** | Email: jkinyanjui@karu.ac.ke<br>Phone No: +254720649845 |

**Expected Learning Outcomes:**

By the end of the course, the learner should be able to:

i. Explain and perform calculations on different survival models.

ii. Carry out the calculations involving both the complete and incomplete life times.

iii. Evaluate estimators from given data.

iv. Apply the different numerical methods in multiple state models.

v. Use SAS, STATA and R statistical software in analyzing Survival data.

**Course Content**

Definition: Survivor, hazard and cumulative hazard functions. Left, Right and Interval Censoring. Univariate estimation including the Kaplan-Meier and Nelson-Aalen estimator. Parametric estimation of the survivor function. Parametric and Non-Parametric Comparison of two groups. Statistical methods for censored survival data arising from follow-up studies on

human or animal populations, Comparison of survival curves, log-rank test, regression models including the Cox proportional hazards model with application, competing risks. Introduction to accelerated failure time models. Use SAS, STATA, R and S-plus statistical software in analysis of Survival data.

## Lecture Schedule

| Week | Topic | Sub- topic | Requirements |
|---|---|---|---|
| 1 | **Introduction** | • Special features of survival data<br>• Examples of survival data<br>• Left, Right and Interval Censoring<br>• Survivor function | Laptop & Calculator |
| 2 | | • Hazard function<br>• Cumulative hazard function. | Laptop & Calculator |
| 3 | **Univariate Estimation** | • One sample non-parametric method; Kaplan-Meier estimator | Laptop & Calculator |
| 4 | | • One sample non-parametric method; The Lifetable or Actuarial estimator | Laptop & Calculator |
| 5 | | • Estimating the cumulative hazards; Nelson-Aalen estimator | Laptop & Calculator |
| 6 | | **CAT ONE** | |
| 7 | **Comparison of survival curves** | • Parametric estimation of the survivor function<br>• Non-parametric estimation of groups | Laptop & Calculator |
| 8 | | • Two sample tests: Mantel-Haenszel Logrank test | Laptop & Calculator |
| 9 | | • Linear rank logrank test | Laptop & Calculator |
| 10 | | • Wilcoxon test | Laptop & Calculator |
| | **Modeling of survival data** | • Regression models with applications<br>• The Cox Proportional Hazards model | Laptop & Calculator |
| 11 | | **CAT TWO** | |
| 12 | | • Introduction to accelerated failure time models | Laptop & Calculator |
| 13 | | • Exponential and Weibull hazard models | Laptop & Calculator |
| 14 | | **REVISION** | |
| 15 &16 | | **END OF SEMESTER EXAM** | |

**References**

1. Regina C. Elandt-Johnson, Norman L. Johnson (1999), *Survival models and data analysis*. Wiley, New York. Available at http://opac.karu.ac.ke.

2. Collett (2015), *Modelling Survival data in Medical Research,* Third Edition.

3. Kalbfleisch JD and Prentice RL (2002). *The Statistical Analysis of Failure Time Data,* John Wiley & Sons. Second edition.

4. Klein JP and Moeschberger ML (2003). *Survival Analysis: Techniques for Censored and Truncated Data,* Springer-Verlag. Second edition.

**Lecturer: Prof. J.K. Kinyanjui**          **Sign:**          **Date: 2/09/2024**

Was the course outline issued on the first lecture?    | Yes |    | No |

**Class Rep** _____          **Sign:** _____ **Date:** _____

*Approved for circulation by:*

**HOD  Dr. Daniel Achola**          **Sign:** _____ **Date:** _____